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CILICIA, TARSUS, AND THE GREAT TAURUS PASS.

By Prof. W. M. RAMSAY.*

I. Cilicia.

Bearing in mind that Asia Minor consists of a lofty quadrilateral plateau closed in by a rim of mountains, which are edged with a fringe of low coast-land and sea-valleys or glens extending up into fissures in the mountain-rim, we may roughly describe Cilicia as being that part of the fringe which lies in the extreme south-eastern corner, between the sea on the south and the mountain-rim (called Taurus) on the north. As to its other boundaries, Cilicia on the west is hemmed in by the mountain-rim, which broadens out till it touches the sea, and on the east it is shut in by a single ridge protruding to the south from the Taurus, and named Amanus. Thus Cilicia is marked off, as with a giant's hand, by bold and lofty mountain ranges, and it lies far down under them, beside the sea, well-watered, fertile, and requiring, for the most part, only the minimum of work and forethought to maintain that proper balance between water and soil which in those countries is the prime condition, and which can rarely be attained in them except with great care and elaborate preparation. The maintenance of the balance requires both that the waters which flow down from the surrounding mountains should not be allowed to form marshes in some places, and that their fertilizing influence should not be denied to other parts. At the present time long neglect has permitted some portions of Cilicia to become useless from one or other of those two causes; but still,

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considerable part is productive in the highest degree, with little attention to irrigation.

In addition to the sea-plain, Cilicia contains a tract of higher land, viz. the foothills which are interposed to break the transition between the lofty Taurus mountains and the coast, and also a part of the Taurus ridge itself. But these hills and slopes have had no independent character in history; they were simply adjuncts to the fertile coast-plain, enabling the population of the latter to maintain health and vigour in themselves and in some classes of their domestic animals by utilizing the differences of level and of temperature.

This land, called the Level Cilicia by the ancients, is remarkably homogeneous, both geographically and historically. It is separated from the rest of the world by very commanding boundaries, and within it there is no emphatic division to mar its unity. Generally speaking, it fell before an invader as a whole or it successfully resisted as a whole.

But no country is absolutely homogeneous geographically; and where there is any free national life, some divergence of feeling and interest must arise between the parts and introduce the element of competition and rivalry. Only where there is a dead level of stagnation, as in modern Turkey, can there be perfect homogeneousness in the people and the cities and the history of any district. The principle which is emphatically expressed in the Cilician country is that the historical differences are obviously founded on the geographical divisions.

Even a slight examination of the map shows that the Level Cilicia is divided into two plains, the Lower and the Upper. The Lower or Western Plain is triangular in shape, with the sea at its base, and its apex in a recess of the foothills. Along with it must be included (1) the slopes that lead back to the northern limits on the broad back of Taurus, and (2) a very narrow strip of coast on the west, where the plateau mountain-rim and the intermediate lower hills come closer and closer to the sea. The Western Plain is watered and drained by three rivers, Cydnus, Saros, and Pyramus; and many minor streams flow from the edge of Taurus through the foothills to join these rivers, or, at the western end of Cilicia, to fall direct into the sea.

The Upper or Eastern Plain lies higher up on the Pyramus and its tributaries. It is divided both from the sea and from the Western Plain by a ridge called Jebel-Nur,* which protrudes from Amanus westwards along the coast, and at one point approaches so close to the northern foothills as to form a narrow pass. Through this pass the river Pyramus finds its way from the Upper to the Lower Plain, and where it enters the Lower Plain there stands in the gateway an ancient city, now Missis, formerly Mopsou-Hestia,† commanding the crossing of the Pyramus.

* The south-western end is called Dede-Dagh.

† "The Hearth of the prophet Mopsus."

This position determines its tragic history. Its position was strong, and yet not strong enough. The hills could readily be crossed, and the city could thus always be surrounded by an invading force. It lay on the track of every army. It was captured by every even temporarily successful invader, and usually destroyed by each of them; yet its position was so important at the great crossing of the Pyramus that it must continually be restored, only to perish once more in the next invasion during the pitiable period of Cilician history between 650 and 1615.

Along with the Eastern Plain must be reckoned the slopes that lead up to Taurus and to Amanus, as well as the whole Jebel-Nur and its strip of coast-land.

Under the Roman Empire Cilicia was at first a mere adjunct to Syria, and afterwards a province along with the countries on the west and north-west. But as growing civilization produced more complex organization, Cilicia, in the early fourth century, became a separate province, and finally, about 397, was divided into two distinct provinces, First and Second Cilicia, which correspond exactly to the two geographical parts above described. Failure to observe the geographical character of this division has led the recent Austrian explorers, Messrs. Heberdey and Wilhelm, into error, for they place the city of Augusta, which belonged to First or Western Cilicia, in the extreme east of Second Cilicia,* *i.e.* the Eastern Plain.

But even before the formal separation, the difference between the two plains made itself apparent in history. One was a maritime plain and in closer relation with foreign countries; it was the larger, and was the seat of a civilization of earlier and more Europeanized development. The other was an inland plain (except the strip of coast on the south of Jebel-Nur), for a long time more Oriental in character. The contrast between the two plains was expressed in the rivalry between their two capitals, Tarsus in the Western Plain, and Anazarbus in the Eastern, and the story of that rivalry would fill a curious page in history. So long as any true municipal life exists, such rivalry is inevitable and not necessarily unhealthy; it ceases only in a dead-level of apathetic and characterless monotony.

II. Rivers and Cities of the West Cilician Plain.

But even the Western Maritime Plain has not a homogeneous history strung on a single thread or connected with the fortune of a single leading city. It contains three great rivers, and each of these has for a time supported the chief city of the whole plain, the centre of distribution and trade. The cities—Adana on the Saros, Mallos on the

* See their *Reisen in Kilikien*, p. 2. M. Imhoof Blumer also placed it in that neighbourhood. The determining condition for Augusta was pointed out in the *Historical Geogr. of Asia Minor*, p. 384.

Pyramus, and Tarsus on the Cydnus—reflect the part which the rivers have played in making and moulding the country and its history.

Each of the three rivers in succession has offered for a time the chief channel or harbour for such maritime trade as existed, and thus given the pre-eminence to its own city. The Saros and the Pyramus both carry a much larger body of water than the Cydnus, afford direct communication with much larger territories, and flow near the central axis of the country. Yet in past history Tarsus and the Cydnus have played a much greater part than Mallos or Adana with their respective rivers. The story of the manner in which the rivers have, first of all, made the country, and afterwards moulded the history of man in the country, has never been written. I am not competent to describe it fully; but even the part which I seem to see with clearness and certainty would require a large chapter to itself, and in this paper it is only possible to indicate what is needed for understanding rightly the nature and importance of our main subject.

Here, on a comparatively small scale and within rather narrow limits, the influence of natural conditions, and particularly of rivers, on human development is expressed in such broad and emphatic outlines that it can be studied with unusual clearness. And if the scale is small in comparison with the great modern countries, it is large in comparison with ancient Greece; that feeling of tininess, as of a toy-country with children playing at history, which has been the first impression on the mind of many travellers as they looked over the little plains of Argos and Mycenæ, or of Athens, or of Olympia, has no place in the mind of a traveller in Cilicia. On the contrary, as one stands on the top of the highest house on the acropolis of Adana, and looks north across the low intervening hills to the summits of Taurus, and south over the apparently limitless plain which the ancients called the Aleïan, the sense of greatness and wide extent is quite out of proportion to the actual measurements, for that apparently limitless plain between Adana and the sea contains only 800 square miles* of arable land, with a strip of sand-hills and lagoons along the coast.

There was a time when the level West Plain of Cilicia was a great arm of the sea. That gulf has been gradually filled up by the two great rivers, Pyramus and Saros (aided probably by a slight rise in the level of the land †), and of these the Saros has been the chief agent in determining the character of the plain.

The Pyramus keeps close to the bounding hills of Jebel-Nur on the east, creeping round their outer edge. It flowed into the sea, during the Greek and the Roman period, on the west side of the little isolated

* The estimate is taken from Major Bennet.

† Dr. Christie, of Tarsus, told me that a succession of old sea-beaches can be traced, marking out the shape of the former gulf.

ridge of hills on which Mallos was situated. Afterwards, during the middle ages, it changed its course, and now it hugs still more closely the edge of Jebel-Nur, creeping round until its mouth flows back to the east into the bay of Ayash, which it is rapidly filling up. Thus it now flows on the east side of the Mallos hills. Throughout history its agency has been confined to the extreme eastern edge of the Lower Plain of Cilicia.

Mallos occupied a position of peculiar importance in early time. It was safe and strong from its situation on a hill. It was close to the sea, but it faced, not towards the sea, but the river (as Scylax says);* and it had at Magarsus the mouth of the river to serve as its harbour. From its coinage we see that it was the old port-city of Cilicia, the earliest seat of Greek influence and trade, and the chief centre of distribution for the plain.† But its greatness lies far back at the very beginning, and even before the beginning, of recorded history. At that time the Pyramus was, as I believe, the only well-defined river-entrance on the Cilician coast, and the first river produced the first city.

The key to early Cilician history lies in the development, *i.e.* the gradual defining, of the river Saros. This river has been a great problem to modern geographers, such as Prof. Carl Ritter in his monumental 'Erdkunde von Asien.' Why is it that some of the old Greek writers speak of the Saros as flowing into the sea, while others omit it as if it never reached the sea by an independent mouth? A fantastic theory has been devised by Langlois, and mentioned with toleration though not definitely accepted by Ritter, to the effect that the Saros channel varied to an extraordinary degree; that it sometimes joined the Pyramus, and other times had an independent mouth, and again resumed its connection with the Pyramus; and that this change back and forwards has occurred many times.

I do not dispute the fact that the Saros may at an early time have joined the Pyramus. Sir Charles Wilson's opinion is that it did so, and that the channel can be traced; and we may safely follow his opinion on such a matter.‡ That is not the point which here concerns us.

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* Dr. Heberdey follows M. Imhoof Blumer in placing Mallos 15 miles up the river, in a marsh where the old and the modern arms fork; they disregard Strabo's express statement that it was situated on a height, and his implication (shown in his following paragraph) that it was a coast city. The number of stadia given in the Stadiasmus between Mallos and Anticheia-Magarsus cannot be trusted; that authority is full of such errors. The actual site of Mallos has not yet been discovered: it will be found probably on the northern slope of the ridge of hills not far from the village of Kara-Tash.

† The great Swiss numismatist, M. Imhoof Blumer, has given back to Mallos its early coinage (formerly wrongly assigned), and thus made it possible to restore a lost page in history, which here we can only allude to in passing.

‡ I ought, however, to mention that Colonel Massy says the levels are unfavourable to this opinion.

The point is that the Saros, from at least the first century B.C. onwards, has had its separate independent course from Adana to the sea, and has not, during that period of two thousand years, been connected with the Pyramus.

Now we can go back to a very early time, when the lower course of the Saros was a succession of swamps and waste land, and the Alêian plain through which it flows was only half won from the sea. Below Adana the river Saros has a very slight fall to the sea. The railway at Adana is only 19 metres (63 feet) above sea-level; but the course of the river from Adana to the sea is quite 35 miles, measuring roughly along the general line of its channel, and probably about 50 or 60, if its complicated windings are taken into account. Thus long after the Pyramus had a well-defined channel down to the coast near Mallos, the river Saros was struggling through those marshy lowlands to reach the sea

A memory of that early time is preserved in the Homeric poems, in the legend of Bellerophon—

> "When at last, distracted in his mind,
> Forsook of Heaven, forsaking human kind,
> Wide o'er the Alêian Plain he chose to stray,
> A long, forlorn, uncomfortable way."
>
> 'Iliad,' V.

The writer evidently understood the plain to be a melancholy waste, untraversed by any path, uninhabited by man, a scar upon the smiling face of the land, where a melancholic madman might "wander alone, eating his own soul, avoiding the paths of men."

This description can by no possibility be applied to the plain, as it was certainly in the time of Strabo, and apparently also three centuries earlier under Alexander the Great, one of the richest and most populous and highly cultivated districts known to the ancients. But it applies rightly to the plain as it must have been at some earlier period. As usual, when we can compare the Homeric description with natural conditions which have been in a process of change, the poem takes us back to a very early stage in the process. It preserves a true tale of ancient days, brought to the Ægean harbours by the first Greek sailors who traded to the port of Mallos; and that story probably carries us back as far as the ninth century B.C., and opens before us a page in the gradual formation of the Cilician land and the Cilician river.* How far human work co-operated with nature in defining the river is a question on which proper exploration would doubtless throw light.†

Strabo, with his usual accuracy, mentions that the Alêian Plain did

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* I do not touch on the question whether the form in which the 'Iliad' gives the story shows any traces of alteration and lateness.

† It is, perhaps, connected with the question as to the unknown site of Augusta, founded A.D. 20.

not reach down to the sea. The modern travellers explain this. There is a strip of sand and waste land and lagoons along the coast, 2 or 3 miles in width, which Sir Charles Wilson describes as consisting of "sand-hills about 10 feet high, cane-brakes, lagoons of fresh and salt water, and two permanent marshes." The true Alêian Plain lies inland from this waste shore.

Strabo gives a minute description of the Cilician coast-line. He was an admirably careful geographer, whose work (so far as his own land of Asia Minor is concerned) impresses one more and more with its thoroughness and trustworthiness as one knows the country better. He describes the Cydnus mouth, and then he passes on to the Pyramus mouth, leaving the Saros unnoticed. Yet he alludes several times to the upper course of the Saros and its greatest tributary the Karmalas,* and relates how a flood in the Karmalas injured certain lands in the neighbourhood of Mallos. This seems very strong evidence, both negative and positive, in favour of those who maintain that the Saros joined the Pyramus in Strabo's time. Could Strabo be called a good geographer if he omitted the mouth of that important river? Could the Karmalas flood injure those lands, if the river flowed many miles to the west of Mallos?

But Ptolemy's evidence is clear, shortly after Strabo's time, that the Saros did not join the Pyramus. To infer from Strabo's silence that the Saros had no independent course to the sea is false. The reason why he is silent about the mouth of the Saros is that it was altogether unimportant for his purpose; it supported no city on its lower course, and it offered no harbour for trade. Its sluggish current ended in a lagoon, with a bar of sand half dividing it from the sea, and not even the small ships of the ancients could enter it. It exercised no effect on commerce and on civilization, and therefore it lay outside of Strabo's subject. The *argumentum a silentio* not merely gave a false conclusion; it also missed the real conclusion which can be drawn from Strabo. When read aright, Strabo opens to us another page in the building up of the Cilician land by the Cilician rivers. The Saros had still no direct entrance into the sea in his time, but ended in a lagoon, as indicated in the accompanying map.†

Now, a glance at the course of the river below Adana shows that great flood coming down the Saros would overflow the country on the south-east, below the great bend of the river, but not the country on the west. These lands on the left bank were, beyond all doubt, part of the territory subject to the great city of Mallos, and the injury

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* Prof. Tomaschek still maintains the old error that the Karmalas was a tributary of the Pyramus (see *Hist. Geogr. of Asia Minor*, p. 288, on the point).

† This appears from the distances stated in the *Stadiasmus Maris Magni*, and suits both Ptolemy and Dion Chrys., xxxiv., well.

caused by such a flood would affect chiefly the people of Mallos. That sudden and transitory flood would do little harm in the upper and middle course of the river, but below Adana, where the stream meanders in its almost level channel, it would sweep headlong over the lands between its left bank and the sea.

Thus it was not till long after the Alêian Plain had been deposited and brought under human care and cultivation, that the Saros acquired a definite and well-marked mouth towards the sea. In the Roman period it still flowed into the large lagoon beside the modern Merkez, less than 9 miles east of the Cydnus, and 15 miles west of the Pyramus, as the *Stadiasmus* says.

But the building up of the Lower Cilician plain, and the reason why that work necessarily ceased at the modern coast-line, so that there has been extremely little change in the Cilician coast-line since the time of Strabo (except in the bay of Ayash, which is protected from the current that sweeps and protects the open coast-line)—all that forms a separate chapter.

We now see why the Saros could not develop a maritime city before the time of Strabo. We have next to examine how the Cydnus developed a great trading city.

In that early time when Mallos was the great Cilician port, the river Cydnus flowed not into the sea direct, but into a lagoon or Rhegma, into which the sea broke over its bar of sand. Tarsus was not at that time a city with a harbour; and it could not be a centre of trade. In that early period the Greek city Mallos, the trading capital, is contrasted with Tarsus, the Oriental city. That lagoon has long ceased to be a lagoon; it is now an inland lake, supplied by fresh-water springs and by overflow from the Cydnus, which no longer flows into the lake, and reaches it only by occasional overflow. But the very name Rhegma shows that it was originally a lagoon, half barred from, half connected with, the sea.*

This change in the course of the Cydnus was due to human agency: it was the work of Justinian in the sixth century after Christ.† Before that time the Cydnus flowed into the Rhegma, and thence reached the sea. But already, in the time of Strabo, about A.D. 19, it was no longer a lagoon, but only a wider part of the river-channel, serving as harbour and arsenal of the city; and the river flowed on in a well-defined course with a full body of water into the sea.

The conclusion seems clear. Engineering operations had assisted nature and helped to define the lake and the lower course of the river, to regulate both, to embank them and border the lake with piers and

* The meaning "lagoon" for the Greek ἔῆγμα seems clear, but is not given in the Lexicons.

† The course just above Tarsus is wrongly indicated in the accompanying map, following R. Kiepert. See Appendix IV.

dockyards.* The useless lagoon had been converted into an admirable harbour, perfectly open, yet completely land-locked. This great operation must be understood as a part of the improvements whereby Tarsus had ousted Mallos from its rank as the chief port-city of Cilicia. Thus ancient Tarsus, like modern Glasgow, made its own river and its own harbour.

But, owing to the very slight difference of level between the lake and the sea, it must have required constant care to keep the harbour of Tarsus open; and in the stagnation of later Byzantine times, and the ruin and carelessness of Mohammedan rule, the harbour became closed. The operation of Justinian (though, as I believe, it was intended only as a safety-valve, carrying off a dangerous superabundance of water likely to cause a flood in the city, and not to turn away the river entirely from the city and the harbour) acted injuriously on the harbour. The old channel through the city became blocked,† and the river gradually turned its waters wholly into the freer channel on the east. Thus at present the old Rhegma is a marshy lake a mile or two west of the river, varying greatly in size at different seasons, discharging a small body of surplus water by a narrow channel into the river 2 miles or so above the sea, turning a great deal of the best land of Tarsus into useless marsh, and breeding fever and insect pests to such a degree as to make Tarsus the most trying place of summer residence that I have experienced in the whole country.

III. The Road across Taurus.

Again, Tarsus and Mallos competed not only for the sea-borne trade, but also for communication with the inner country. The influence of the Greek element is to be traced by the name of Mopsus, the prophet who led and directed the Greek traders. Mopsou-Hestia, the Hearth of Mopsus, marks the road connecting Mallos with the Eastern plain of Cilicia.

The connection of Adana with Mallos, also, seems to have been ancient. They were united not merely by their common opposition to Tarsus,‡ but also by the fact that Mallos communicated with the inner country beyond Taurus by way of Adana, which stood at the southern end of the natural pass through Mount Taurus.

But on that natural pass there was one serious difficulty (described

* These features are mentioned by Strabo in his description of Tarsus.

† But this did not finally become the case until the fourteenth or fifteenth century. Early travellers in Turkey saw the river still flowing in part through the city, in which its channel can easily be traced still, by the depression, by the gravel and pebbles below the surface, and by the piers of a Roman bridge seen by Dr. Christie under a house. The modern watercourse on the west side of Tarsus is wholly artificial, as can be seen by following it up to the point where it is taken off from the river.

‡ Dion Chrysostom speaks of their long-standing feud in his second Tarsian Oration.

below in Section VII.). The pass was blocked for waggon traffic by that difficulty at its southern end. This made it possible for Tarsus to compete with Adana by opening another route over Taurus.

Tarsian energy cut through the rocks of the Cilician Gates a new path which avoided that difficulty and placed their city at the southern end of the only waggon-road which crossed Taurus. An important point on that new Tarsian road was called Mopsou-Krene, the Fountain of Mopsus, and the name of the prophetic guide of Greek enterprise shows (as is probable on other grounds) that this great engineering work was a step in the development of Greek commerce. It was the Greek settlers in Tarsus who competed with the Greeks of Mallos.

This is the road which I now shall attempt to describe. This introduction has been intended to show that the evolution of this road, one of the great triumphs of early civilization over natural barriers, is simply one act in the long struggle for control of the markets of the country.

As we go over the road now, it needs an effort to understand how great a triumph of human skill and energy it was originally, when the path had to be found, and built, and cut. So, as one crosses the Alps by the Swiss roads, it takes an effort to understand how the Romans could think that they were an impassable barrier to Hannibal, and how Hannibal could lose half his army in crossing them, and bring only a remnant of half-starved men down on the Italian side. Taurus has never been a barrier so serious as the Alps; but it was a barrier and a terror in the classical period to a degree that we now can hardly cease to wonder at.

Of all the Taurus passes, incomparably the most important in history, and still by far the most important, is that called the Cilician Gates. The Gates formed only one single point on the road, which has a course of more than 70 miles through the Taurus mountains and foothills; but the road may be conveniently named from the Gates, as the most striking feature in ancient history, though far from the most important in modern time or in the future development of the route. But the route as a whole will long remain the greatest and the critical crossing of the whole Taurus range, though the Gates will be avoided, and the railway, if not also the road, will hereafter make its southern end at Adana, not at Tarsus.

The Great Pass has been frequently traversed by travellers, and yet it has been always difficult to find a sufficient description of its course. Every traveller confined himself to wondering and admiring; none took the trouble to make and publish notes, but trusted that their predecessors had done so. Only recently, in a traveller whom hitherto I had ranked low, I found by far the best, most accurate, detailed, and practically useful account of the whole route; and I make my apologies to his shade for a rather slighting reference to one scene in his travels,

which is contained in my 'Impressions of Turkey.' The traveller was Macdonald Kinneir, captain in the service of the East India Company, who passed through the Gates in 1813, in the course of a long journey in Asiatic Turkey.

My account of the road is founded on notes made in two journeys, in 1891 and 1902. On both occasions my wife accompanied me, and the photographs, of which a few specimens are here published, were made by her. I also saw a small part of the road in 1882, in the company of Sir C. Wilson, and traversed it entirely in 1900; but the notes made on those occasions are almost entirely superseded by later ones.

The importance of the pass lies mainly in the past. Those lands have long ceased to be of any serious consequence in the world. They cannot again come to be of importance until better administration and more secure tenure have restored prosperity. But that they should ever again become of prime importance in human history, that the opening up of good communication through the Great Pass should ever become a central question on which human development depends—all that is as unlikely as anything can well be. Yet long ago the making of that road which we are about to describe was one of those critical events on which the fortunes of mankind depended, though, like many other such events, it was unrecorded and unnoticed at the time, and has since remained unregarded by historians.

Only one fact can give real importance to the Great Pass, within the range of possible experience of living men, and that is that railway communication with the East should be established by way of Constantinople and the Euphrates valley. This is the way by which such a railway is likely to cross the Taurus. So far as I am able to learn, there is no other pass which could be mentioned in competition with it, except that which leads from Albistan to Marash, far away to the east; but I cannot find that that pass is so easy to overcome as the Great Cilician way, while it is immensely more difficult to reach it from Constantinople.

There is no engineering difficulty of the slightest consequence in extending the existing railway from Konia to the northern end of the Cilician Pass; I doubt if anywhere a gradient sharper than 1 in 100 would be needed, and there is neither river nor marsh, hardly more than a brook, to cross.* Once placed at the northern end of the pass, the line has a gentle descent down a continuous easy glen—interrupted only once by a ridge of no serious consequence—for about 35 miles. In those 35 miles the descent is only about 2200 feet, giving, without any zigzags,

* Charshamba-Su, 20 miles south of Konia, is the largest channel (though carrying little water), and seven or eight good bridges cross it already; it carries very little water, but has a broad channel with slightly elevated ground on both sides.

a gradient of 1 in 80, roughly speaking.* But then comes the one serious difficulty: the glen ends before a wall nearly 2000 feet in height, with hardly any room for curves in surmounting it. The river of the glen finds its way through an underground channel; but it is no part of our task to speculate about the issue of the railway, whether a tunnel or a mountain railway would be needed. It need only be said that the expense would be very great at this point; but that if a tunnel could be made, the railway could be worked with perfect ease and without any extraordinary expenditure. No other pass offers this advantage.

Of course, no such railway could be made to pay. It cannot be a commercial enterprise under present conditions. But, even on the dead level of the Central Plateau, no railway can be made at present to pay. I doubt very much if the existing lines on the plateau, taken by themselves, and apart from the portions which lie in the coast-lands, do much more than pay the bare working expenses; and I was assured two years ago by a good authority who has a life's experience on the railways of the country, that—within the limits stated—one of those existing plateau railways did not pay even working expenses. There is, however, a steady improvement in the traffic, especially on the German Anatolian Railway.

Those railways of the plateau can be constructed only as means for developing and civilizing the country, or for strengthening its defences, not for immediate return on capital invested. But for the first purpose a railway through the Great Pass to the coast will do much; and for the second purpose that railway, if extended to the Euphrates and the Persian Gulf, will become a matter of European importance, and a centre of interest for every government and every politician in the civilized world. In view of this possibility, a somewhat minute and detailed description of the pass is not without its value.†

IV. The Road from Tarsus to the Cilician Gates.

According to the usual rule in this country, the road from Tarsus to the Gates avoids the valley of the stream which comes down from the Gates to the city. So far as the maps can be relied on, the course of the stream is fairly direct, but there are difficulties, though I do not know that any modern traveller has ever followed the stream throughout its whole course.

The modern waggon-road issues from Tarsus by the eastern gate, which was destroyed not many years ago by the governing pasha after it had lasted, as is said, from the time of Harun-al-Rashid, and coincides for nearly a mile with the road to Adana. It crosses the Cydnus by a

* There is a sharp descent of 400 feet at Chifte-Khan.

† These remarks were printed in 1902, before the Bagdad railway question had attracted public attention.

bridge, and then turns north and ascends the valley of the tributary stream into which Justinian diverted the main river.

Since the railway Mersina-Tarsus-Adana was built, traffic from or to the Gates seeks the nearest point on the railway, viz. a station called Gulek Boghaz, about 2 miles from Tarsus. We began our journey in 1902 from this station, coming by train from Adana, and finding our travelling equipment waiting at the station. On previous journeys we came down from the Gates by the horse-road, which enters Tarsus on the north side, crossing the Cydnus by a bridge immediately below the cataracts. Thus, as it happens, I have never seen the course of the waggon-road for the first 3 or 4 miles from Tarsus.

Two miles north of the railway station, the road enters the foothills in front of the main ridge of Taurus, and follows an easy path up a valley, open at first, but soon narrowing. The whole hill district on both sides of the road is called Bairamli-Toprak (soil of Bairamli); and the central village, Bairamli, lies about 2 miles west of the waggon-road, and 10 north of Tarsus.*

This district was, certainly, much used by the ancient Tarsians for country residence. It is close to Tarsus, and yet has a healthier situation than the city in the plain. The name of Eski-Tarsus, "Old Tarsus," which clings to the ruins a mile east of Kavakli (a tiny settlement at a khan in the Bairamli district on the waggon-road 16 kilometres from Tarsus), shows that some recollection of the close relation between the city and what may be called "the suburbs" on the hills, survived in local popular nomenclature. But the principal Roman remains lie on the Roman road west of Kavakli (see next section).

At Tash-Ovasi (between 27 and 28 kilometres, 18 miles), one of two alternative roads from Adana joins our Tarsian road to the Gates, and a khan stands by the road north of the junction. In this part of its course the road traverses high, rolling, broken, but fairly well-wooded country: fir, cedar, plane, oak, and other trees abound in the country round and further north. A striking and picturesque castle, apparently mediæval, has been for some time visible at a considerable distance straight in front; it is now called Kiz-Kalesi.

After the khan the road turns more to the westward, and, after 2 or 3 miles, enters a picturesque and well-wooded glen running from north to south. The road at first keeps high on the east bank, and then crosses the stream to the right or west bank. In this neighbourhood it meets the line of the Roman road, but I did not succeed in determining the exact point. The village of Muzar, and a ruin called Yanifa Kishla, lie a little to the right of the modern road, which now leaves the glen, crosses a low plateau, and enters another glen, running north and south.

* I speak of Roman miles throughout the paper: roughly speaking, 2 make 3 kilometres; 10 make a little over 9 English miles.

In this glen, which we now enter, flows the water that descends from the Gates. The scenery is here magnificent, and it grows more and more grand and impressive as we advance northwards towards the Gates. As we enter the glen from the east, we observe a road ascending from the stream up the opposite hillside, 400 to 500 feet, and disappearing across the hill; it is said to be the horse-road from the Gates, leading direct to Tarsus. Thus neither the horse-road nor the waggon-road follows the direct watercourse down to Tarsus.

At 38 kilometres from Tarsus is Mazar-Oluk-Khan,* where, according to the regular order of easy travel, the first day's journey from Tarsus ends. The journey is short, but we have ascended more than 1900 feet from the railway, and are now about 2000 feet above sea-level. The road here is still on the east side of the stream, and at some height above it; and the glen is more open at this point, though still confined between the two hill-ridges.

The ancient Mopsou-krene, the fountain of the mythical prophet Mopsus, is commonly supposed to have been situated close to this point; and some traces of ancient life were observed by Langlois on a wooded hill to the north of the khan. In the same neighbourhood Colonel Chesney and Mr. Ainsworth stayed at a village, Bostanlyk, "the place of gardens;" † but at the present day no such village exists. Presumably it was destroyed or abandoned when the Egyptian army held the Cilician Gates. Langlois, in 1852, who found no village of that name, doubts whether it ever existed; but the older travellers would not invent a village.

But the most serious difficulty lies in the doubt whether the Roman road traversed the glen of Mazar-Oluk. It will be shown in the following section that it probably took a different line.

North of Mazar-Oluk the scenery continues similar. The road keeps on up the gorge, and then crosses to the west side; but after a mile or so recrosses to the east bank (after the 44-kilometre stone), and immediately afterwards we reach Sarishek-Khan,‡ where the second of the two roads from Adana to the Gates joins our road. The glen here opens to a small valley, and there is considerable cultivation. One would expect that the principal town of the district should be here rather than at Mazar-Oluk, and such has been the case throughout the Turkish period, as the remains show. But Mopsou-krene could not be situated here, for the distance from the Gates is only 9½ kilometres (a

* Mazar-Oluk, "Grave-hillock." Oluk is a very common element in Turkish nomenclature, much misrepresented by European travellers. This name, *e.g.*, is given variously as Mezerlyk (*i.e.* graveyard), Mazari-kolou, etc.

† It may be suspected that the ruins of this village are those which Langlois took for the traces of ancient life.

‡ Sari-Ishek, "Yellow-donkey;" called Sarik, "Turban," by Langlois.

little over 6 miles), whereas Mopsou-krene was 12 miles distant from them.

Sarishek is also the junction of the other road (referred to above) from Adana to the Gates,* and must always have derived some importance from being a meeting-place of roads, much superior to Mazar-Oluk in its long narrow glen. An abundant fountain of water is also a feature here. It is artificial, but the water must rise in the hills that bound the open ground not far away.

The natives declare that Sarishek-Khan was built by Ibrahim Pasha; but there are here remains obviously of the early Turkish time. This whole road affords an interesting study in the growth of mythology. Ibrahim Pasha, son of Mehemet Ali, held Cilicia from 1832 to 1840, and opened up the road to carry his guns over the mountains. He has now become a mythological hero, and almost every building or work of any consequence along the road is attributed to him, from the ruinous little khan of Sarishek to the vast old Turkish building called Ulu Kishla ("the Long Barracks") at the northern end of the pass. Perhaps even the Arch of Severus† is attributed to him, but for this I cannot vouch. It is not strange that his victorious progress across Taurus and through Asia Minor to Kutaya, his victories over the Turks, even when Von Moltke was directing the Turkish artillery, and his abundant vigour and energy, should have caught and kept a place in the stolid and unobservant mind of the Oriental peasant. He was the last of the great Oriental conquerors, no unworthy successor of Tamerlane and Genghiz Khan, of Cyrus and Tiglath-pileser; but he fell in the age of European ambassadors and the Great Powers, and his career was arrested in the middle of his triumphant march on Constantinople.

But it is an interesting example of the general law of human nature, or at least Oriental nature, that, so far as I heard, not one word of truth or history was remembered about him along the road, though he was mentioned by almost every one we talked to. His real character and his real deeds had been entirely forgotten, and a series of demonstrably false acts were attributed to him. Some of these unhistoric acts have passed into European books, and it will be worth while to correct them as we go, and to notice from time to time the way in which this historical personage has within sixty years become a mere legend.

There is also at Sarishek a ruinous turbé, the first example which we have seen on this road of that very common kind of religious foundation. The turbé, or ziyaret, always contains the tomb, supposed or real, of some holy personage, who usually bears a Mohammedan name; but in many cases the holiness of the turbé obviously dates from pre-

* These roads from Adana to the Gates must, of course, be distinguished from the road connecting Adana with the natural pass through the Taurus, *i.e.* the road from Adana direct to the vale of Bozanti, Section VII.

† See next section.

Mohammedan time, and it may be laid down as a general rule that the turbés are the chief of the many ways in which Mohammedanism has adopted and maintained, under a superficial varnish of its own character, the ancient religious beliefs or superstitions of the country. It is worthy of note that the sacredness of the spot is regularly associated with a grave, for that was the foundation on which the primitive holiness of places rested in Anatolia. The turbés in general have in recent years fallen into disrepair and disrepute; the revenues for their maintenance were all taken possession of by the state in the time of Mahmud II., and the government charged itself with the duty of maintaining the religious establishments—a duty which has been performed as all other duties of administration are performed in Turkey.

I tried to find out the name of the Mohammedan saint, or dede, who was buried at Sarishek, but in vain. No one knew. One old man, at last, declared the turbé contained the grave of a dede named Omar, a name which I have observed in other parts of Asia Minor as the bearer of the religious inheritance under the form of Omar-Baba ("Old-Man-Omar"); but I was uncertain whether my aged informant was speaking the truth, or merely wished to get rid of a persistent questioner by satisfying his desire for information. Every traveller has to guard against that most dangerous source of error, information given because it is evidently desired.

There must have been a small ancient town or village in this tempting position; and the Turbé is evidently the expression of the awe which always attached to the tradition of ancient life and greatness in Anatolia.* In treating that subject elsewhere, the writer pointed out that the turbé is very frequently the indication of an ancient site, and that a religious map of the country would be a good guide to its ancient history. A town necessarily was a religious fact as well as a social fact, and no religious fact seems ever to be entirely lost in Anatolia. The local religion is permanent amid all changes in the national religion.†

Even the mere junction of two roads was a religious fact to the ancient mind; and the religious idea of the Three Ways was anthropomorphized as a goddess in Greece and Rome. The form which that religious fact assumed in Asia Minor requires investigation in a more suitable place; but there is some probability that the symbol called Triskeles was in Asia Minor only a rude indication of the meeting of three ways—a symbol which, when the craze for solar symbolism was at its height, was interpreted as the sign of the sun in its course. The

* It is necessary to add that there is in the gorge, a mile or two north of Mazar-Oluk, but on the opposite bank, a sacred tree; in my notes there is only the vague information that it is between the kilometre-stones 39 and 42.

† See a paper by the present writer on the "Permanent Attachment of Religious Veneration to Localities," *Transactions of the Oriental Congress in London*, 1892, pp. 381 ff.

symbol is often found on coins of the cities of that country.* Sarishek, then, is situated at a place sacred as a meeting of three ways.

The sides of the gorge grow loftier, and the gorge itself narrower, as we advance. The road crosses the stream by bridges five times between Mazar-Oluk and the Gates. At about 49½ kilometres from Tarsus we reach Giaour-Harman, in a small opening of the gorge, and at 50 kilometres a new khan called Ala-Begirli. Thirteen minutes after Ala-Begirli † there were visible, what I took at first for the foundations of a Roman bridge, barely appearing on the surface of the ground at the edge of the stream about 20 feet below on our left; but as there seemed to be no trace of or place for a Roman road on the opposite side, the

FIG. 1.—APPROACHING THE CILICIAN GATES FROM THE SOUTH.‡

foundation must have been intended to carry the wall or arch supporting the road.

At last there appeared in front of us a lofty ridge or wall of rock, stretching from east to west right across the line of our path, the front

* It is confined almost entirely to cities where the Hellenic spirit was weak and Hellenic education little known; *e.g.* Olba, Adada, Etenna, Aspendus in early time, and early Lycian coins. It belongs, therefore, to a religion which was non-Hellenic, and it disappeared when a Hellenic varnish was put over Anatolian religious ideas.

† Our course here was very slow, as the surface of the road is very bad. As a proof of the uncertainty of dead-reckoning by time of march, on which my route-surveys have always been based, it may be mentioned that our driving-time per kilometre varied between six and twelve minutes.

‡ The appearance of height in the mountains cannot be truly given in the photographs; this is especially the case in Nos. 1 and 9, where they are dwarfed.

wall of the main mass of Taurus. It can hardly be less than 1500 feet in sheer height above us, as we first see it. It would bar the progress of any one except an active mountaineer, were it not for a narrow cleft which pierces it from north to south, where the water of the stream finds a passage from the broad back of the Taurus plateau down through our gorge to the Cilician Plain. This cleft is the Cilician Gates in the strict sense. Six minutes before reaching the entrance the road crosses the last bridge, and passes the Gates, 54 kilometres from Tarsus, on the west or right bank of the stream. The view from beside the bridge is singularly grand.

V. The Roman Road from Tarsus to the Cilician Gates.

In 1902 we had to choose between two alternative courses—either to examine the modern waggon-road, or to search for the precise line of the Roman road. We preferred the former course, partly because it seemed more useful in a geographical point of view, partly because the search for the Roman road might require a long time, which we had not at our disposal, and partly because we could thus travel by waggon, which, while less pleasant, is also less expensive. The modern road has been measured, and many kilometre-stones erected at rather uncertain intervals along it; so that it now forms the foundation for a geographical study of the region.

The general course of the Roman road is certain in the first 12 miles north of Tarsus, and in the final part between Sarishek and the Gates. In the latter it coincides almost exactly with the modern road; in fact, nature offers no alternative. The intermediate part of the road is uncertain.

The chief question is whether the Roman road followed the water (as the modern road does) down from Sarishek to Mazar-Oluk. In this part we observed no trace of old work, building or cutting, and though this is not conclusive (as it would take a long time to examine sufficiently minutely to justify a confident negative), yet it creates a doubt whether the ancient road traversed this southern part of the gorge.

The known facts about the course of the Roman road may be summarized as follows:—

The modern road at first keeps to the lowest level along a small stream. The Roman road followed a more direct course, 1 to 2 miles west of the modern line, on higher ground; but though this line is more undulating and broken than that of the modern road, yet by more expensive works the Roman road may probably have been made as suitable for traffic as the modern line. A little to the north of Bairamli, Langlois in 1852 traced the line of the Roman road for a distance of 2 kilometres; and the same line is still well marked, running almost directly north about 2 miles west of Kavakli. He says that it is paved with large slabs, and is 3 metres broad. His account is confirmed in

every respect by the Rev. Dr. Christie of Tarsus, who recently followed the line of the road in that part, and sent me photographs.

On the summit of a high plateau, about 1400 feet above the sea (according to his estimate), a triumphal arch spans the road.* It is still almost as perfect as when Langlois saw it in 1852. Situation and construction show that the arch is of the Roman time. Langlois says that tradition assigns it to Constantine, but he does not specify what he means by tradition. There is not, in the strict sense, any tradition in the Turkish lands about the origin and character of ancient buildings; there are merely the fancies of modern inhabitants who have acquired some education. The view which elsewhere I have ventured to suggest† is that this is the ruin of a triumphal arch, built by the Tarsians in honour of the victory of Septimus Severus in 194 A.D. Severus came down through the Gates, and defeated his rival Pescennius on the coast near Issus. In commemoration of this event an arch was erected near the scene of the victory on the Syrian frontiers; but the Tarsians mention on their coins a different arch, which they erected at a place in their own territory near the northern frontier. The place was named Kodrigai, a Graecized form of the Latin Quadriga, because the arch was surmounted by a four-horsed chariot carrying the deified emperor. The name is given on coins of Tarsus in the third century, which show that games were held by the city on the high, open, undulating plateau which the Roman road here traverses.

Immediately beyond Sarishek-Khan, when the gorge again narrowed, we began to find traces of the Roman road, and these were nearly continuous till the Gates were passed. The ancient road was made in the steep bank, by cutting the rock on the higher side and by building on the lower side, so as to give a sufficiently broad platform. The ancient cuttings of the rock can be distinguished at a glance from the fractures made by blasting for the modern road, which also is a work of considerable magnitude and well executed, except between Sarishek and the Gates.

It was also noteworthy that the Roman road was always, so far as I observed, throughout this part of the gorge, on a higher level by 3 or 4 feet than the modern road.‡ There must, therefore, have been a great amount of building to support the ancient road; and in the Roman fashion that was, beyond doubt, done with cut stones. Yet I did not observe a single cut stone in the whole length of the gorge, though in one case I noticed by the water-side the cut foundations to carry the supporting wall (see the preceding section).

I mention this, as some of those who have not seen the Midas-city in

* It is more than a mile north of Bairamli village, and about 2 west of Kavakli.

† *Bulletin de Corresp. Hellenique*, 1898, p. 2376.

‡ Precisely the same observation was made by the German botanist, Th. Kotschy, about sixty years ago (Ritter, Kleinasien, ii. p. 281).

Phrygia have expressed doubt as to my identification of the line of walls of the ancient city, on the ground that I did not find a single one of the stones of which the wall was built, but only the rock-cuttings made to receive them.

One must be struck with the contrast between the numerous traces of the Roman road here, and the absence of traces in the glen of Mazar-Oluk. It seems probable that the Roman road, coming south down the narrow glen from the Cilician Gates, diverged from the glen at Sarishek, and kept away slightly east of south over the Boz Bel, and so down to somewhere near the village Muzar. This gives a more direct route, and the appearance of the country as one looked north from the neighbourhood of Muzar, or south from Sarishek, did not suggest that there was any obstacle insuperable to Roman engineers, who were not fettered by considerations of cheapness in laying out their roads.

Kinneir in 1813 followed the course which has just been conjectured for the Roman road. He describes in his clear and accurate way his route from the Gates as far as Sarishek-Khan (which he does not name), "near the mouth of the gorge." Formerly I thought this was a mere lapse of memory on his part, due to his confusing Sarishek with Mazar-Oluk. But when the theory of the Roman road was wrought out, Kinneir's accuracy was triumphantly established. He came down the gorge till it widens at Sarishek; there he turned away south-south-east, as he says, "through a country interspersed with gentle slopes." Though the traveller coming from Mazar-Oluk finds Sarishek about the middle of the defile, yet one coming from the north thinks that the defile ends at that little open glade with its fields and buildings; provided that he does not go on to Mazar-Oluk and discover that the gorge closes in again immediately. But Kinneir turned away south-south-east, through "a country interspersed with gentle slopes," a description which suits the supposed Roman route well, and the Mazar-Oluk road very badly.

After reading several times Kinneir's clear and carefully estimated description of his journey through the Great Pass, one becomes convinced that he turned out of the gorge at Sarishek, and travelled direct to Muzar and Bairamli without seeing the continuation of the gorge at Mazar-Oluk. With some travellers one might suppose a lapse of memory and a mere omission of the lower part of the defile; but Kinneir was evidently keenly interested in the Great Pass, and describes it stage by stage more accurately than any other traveller who has written about it, and his careful and spirited description may serve as proof that this route, now never used, is both possible and direct.

If this theory as to the course of the Roman road (as indicated on the map) be correct, the historically interesting site of Mopsou-krene on the road would have to be looked for a little way north of Muzar; but no proper exploration of this region has ever been made.

The ordinary view is that Mopsou-krene was situated at Mazar-Oluk, but in examining the locality it seemed to me that as to this identification of Mopsou-krene there is some doubt. Our authorities give the distance from the Gates as 12 Roman miles, *i.e.* 18 kilometres; but Mazar-Oluk-Khan is only 16 kilometres from the Gates. Moreover, a position in this narrow glen seems unsuitable for an ancient town. I should rather look for the site about a mile south of the Khan, on the high ground where the modern road from Tarsus enters the glen, even if it should be found that the Roman road went through the pass of Mazar-Oluk.

On the other hand, it must be acknowledged that Langlois saw the ruins of a small church of the basilica form, and that there is a good fountain at the Khan. Also the discrepancy as regards distance is slight, for anything over 11 miles would be called 12 in the Itineraries. Moreover, Mopsou-krene is not called a town by our authorities, and may have been a mere *mansio*.

I do not know, however, what is the source from which the fountain derives its water; the art of conducting water in hidden channels for a long distance is a branch of engineering art—perhaps the only branch—in which ancient skill has persisted through the Turkish period;* and as a rule it was only natural sources, not artificial fountains, which made for themselves a place in ancient local nomenclature. But I am under the impression that the source is actually at the Khan.

When Theophanes calls Mopsou-krene the first halting-place from Tarsus on the north road (*πρώτη μονὴ ἀπὸ Ταρσοῦ*, p. 46), no inference bearing on this question can be drawn. Mazar-Oluk is the first halting-place for those who are making an easy journey, and Sarishek for those who are travelling fast. Just as little inference is allowable from Ammianus, who says that Mopsou-krene was the last station for travellers before they passed out of Cilicia.

The idea suggested itself to me at first that Mopsou-krene might have been beside Sarishek, which clearly was the site of an ancient village, and that the distance from the Gates should read as VII., not XII. But a fragmentary inscription found in Rome, giving a route from Tarsus† northwards, seems conclusive that Mopsou-krene was several miles south from Sarishek. The first day's journey ended at Mopsou-krene, the second at Panhormus (evidently a large inn near the modern Tekir-Khan), the third at Aquæ Calidæ, the fourth at Tynna, the fifth at Tyana, the sixth at Andabalis (the modern Andaval). Of these the fourth, Tynna, is unknown, but we must suppose it was about halfway

* 'Historical Geography of Asia Minor,' p. 88. In those cases where I have seen native water engineers at work, or heard about them, even in the heart of a purely Mohammedan region, they have been Greeks.

† It is quoted in the 'Historical Geography of Asia Minor,' p. 68. The name Tarsus is lost, but can hardly be doubted.

between the third and fifth. This route evidently implies that each day's journey was between 18 and 22 miles, and the document gives excellent evidence of the ordinary rate of travelling * in ancient time (which is the same as that assumed by me in reckoning the itineraries of St. Paul). It also proves that Mopsou-krene was about 6 miles south from Sarishek, or 2 south from Mazar-Oluk, exactly as the Jerusalem Itinerary places it, 12 from the Gates (and 22 from Tarsus).

Mopsou-krene never became a bishopric. Probably the territory of Tarsus extended up to the Gates, and Mopsou-krene was merely a village in the Tarsian land. The inscriptions, "Bounds of the Cilicians," occurs both on the rock-walls of the Gates and on the coins of Tarsus; and coins of cities rarely, if ever, mention anything outside of the city territory.

VI. The Cilician Gates and the Tekir Summit.

The actual passage of the Gates is about 100 yards long. On both sides the rock walls rise almost perpendicularly (that on the west side literally so, at one point to about 100 feet above the road), and then slope steeply back towards the towering summit of the ridge. A mediæval castle crowns the western summit, evidently a relic of the long frontier warfare between Byzantine and Saracen power, 641–965 A.D.

There has been some rather loose writing about the narrow passage of the Gates, and the Ibrahim Pasha legend is strong here. I have heard it reported that two loaded camels could not pass one another in the Gates, because they were so narrow, until Ibrahim made the opening broader by blasting the rocks; and this statement was repeated by me in conversation, before I had seen the Gates, as a report which I had not verified. A still more exaggerated form of the story may be found.

But examination of the pass shows that such reports are erroneous. Ibrahim did much for the road, but he did not widen the passage a hair's breadth. He simply cleared and rebuilt the ruinous road. The difficulty for camels before his time lay not in the narrowness of the gap between the rock walls, but in the appalling character of the path, which was covered deep with a mass of loose rough rocks, worn slippery and smooth by rain and river-water, and by the passage of men and animals. He probably used powder to break up the stones which encumbered the passage, and thus the legend grew.

Kinneir mentions that at the narrowest part the defile was "not more than ten or twelve paces from rock to rock." Not knowing of his statement, I guessed the breadth at 30 to 40 feet; and Oberhummer, in 1898, speaks of 9 to 10 metres: thus estimates before and after Ibrahim's time agree.

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* On this subject see an article on "Roads and Travel in Roman times" in Hastings' 'Dictionary of the Bible,' vol. v.

It merely requires a plain statement of the facts to show the exaggerated character of the legend. A road practicable for waggons traversed the Gates at least as early as 401 B.C., and remained in use until the Arab invasion in the seventh century after Christ. In the Roman period this road was about 11 feet broad, as is plain at other points. A river also ran through the Gates, which in the wet season must carry a considerable body of water, sufficient to sweep away all vestige of a road unless plenty of space were left free for the torrent.

Moreover, I observed no trace of blasting,* such as one sees in abundance further south down the Pass, and also on the northern side. But at least it can be asserted positively that the roadway throughout

FIG. 2.—CILICIAN GATES: SOUTHERN ENTRANCE.

the length of the Gates is cut by ancient hands from the rock, and the west side (which the road has always taken) shows the ancient surface practically unchanged.

The real state of the case is this. Before the making of the waggon-road (which Xenophon speaks about), there had only been space for the stream. There was no road except the bed of the stream, which could readily be traversed by laden animals and by men during great part of the year, but, when the water began to increase, was impassable in parts, and dangerous everywhere. Room was made for the road by cutting the rocks on the west bank, while the stream was left with its channel unimpaired.

* I feel very confident on this point, though I confess that I did not look carefully for traces.

Now, the question is, when and why was this road constructed? It obviously impairs, though not seriously, the defensive strength of the Gates against invasion. When the Gates formed the northern boundary of a small state, there was, from the political point of view, every inducement to keep the passage narrow and difficult, and thus impede the march of an enemy.

The reason for that really great work of cutting a waggon-road through the Gates lay certainly in trade. This was the final blow in the long contest between Tarsus on the one hand and Mallos with Adana on the other hand for the command of the traffic with the inner lands. The possession of the sole waggon-road across Taurus gave the undisputed superiority to Tarsus. It remained probably the sole waggon-road for many centuries, until the Romans made one from Laranda to Olba and Corycus, following much the same course as the modern waggon-road built by Said Pasha from Laranda to Selefke.

Quintus Curtius, in describing the seizure of the Gates by Alexander the Great in 333 B.C., says that four armed men could barely march abreast through them. This statement must, of course, be understood of the roadway. The Romans improved the path, but it is practically certain that the extreme breadth of the Roman road through the pass was 11 feet, and Langlois states it at 3 metres.

The Roman road through the Gates fell into disrepair in later centuries, and this was not entirely due to natural causes. When Taurus divided the Byzantine from the Arab power, it again became important to make the passage difficult. One of the most obvious ways of doing so was to roll down masses of rock from above; and, at any rate, in such a gap there are likely to be, in the course of centuries, occasional falls of rock disintegrated by natural causes.

In 964, when Tarsus again fell under Byzantine authority, and Cilicia was once more united with Anatolia, the roadway may have been improved, but this is doubtful; and after 1072 the Gates was once more a barrier between Christian on the south and Turk on the north, till at last Cilicia was conquered by Sultan Selim early in the sixteenth century.

How much history lies hid in Kinneir's description about 1812!—"The road was in so bad a condition that it could only be passed during the day; many of the large stones, which had been used in the construction of the Roman way, having been either removed or fallen down, whilst the surfaces of those that still remained in their places were smooth and slippery."

Nothing was actually done to improve the roadway until Ibrahim Pasha found it necessary to carry his guns across the Pass. This improvement was not maintained; but in the time of Said Pasha, about 1882, an effort was made to facilitate traffic, and the road was made passable by waggons, though there was still much difficulty

at various points. Again, recently the road has been greatly improved, and it is easy to drive up to the Gates from Tarsus, though the surface is sometimes rough. North of the Gates the road is now even better than south.

After issuing from the Gates the road passes a guard-house on the left, and enters an open valley, rising rather steeply in front, grown with small fir trees and scrub. Following the right bank of the stream, which here flows from west-north-west to east-south-east, after 10 minutes the road crosses to the left bank, and keeps along it for 45 minutes (passing the 56-kilometre stone at 10 minutes from the bridge, and a khan at 42 minutes). We then turn up due north across the ridge, and in four minutes reach the watershed and the 59-kilometre stone (at 59 minutes from the Gates). The ridge here is broad and level, so that the 60-kilometre stone is much on the same level, about 4250 feet above the sea. The ground is open and stony. High on the right is a fort, seemingly round in form, built by Ibrahim Pasha.

This little plateau, called Tekir, is the middle summit of the Cilician Gates route. There is a higher level at the northern end to traverse before the Central Plateau of Asia Minor is reached, but the ascent there is so gentle that Tekir, with its steep slopes to north and to south, is naturally regarded and spoken of as "the summit of the road."

After the 60-kilometre stone the ground slopes down rapidly to the north, and a little way down the slope stands a small house of entertainment—Tekir Khan. At the khan, which is the humble representative of the ancient Panhormos, mentioned in the document quoted above one naturally halts to review the situation, and study the historical bearing of the localities.

The Gates were the defensive point for Cilicia in ancient times. In that narrow pass, as Captain Kinneir says, "a handful of determined men might bid defiance to the most numerous armies." The position would in that age have been impregnable, unless an enemy could cross the rocky ridge and come down in the rear of the defenders. But from Tekir one sees that that could be done: assailants from the north could get over the ridge either on the east or the west into the gorge south of the Gates. It was therefore necessary to defend the ridge also, and thus the line of defence was widened. It was probably in the time of the Byzantine and Arab wars that a castle was built on the west summit of the ridge, overhanging the Gates and the gorge south of the Gates, but some guard-house may have existed earlier.

In spite, however, of this element of weakness, the Gates formed a great and strong defence, which strikes almost every traveller with admiration and awe. The importance attached to it in military operations, such as the Anabasis or the march of Alexander the Great, is entirely justified by its nature; and the reason why the Crusaders

called it the "Gate of Judas" is clear, for it was the natural enemy of their cause and the betrayer of their safety. As the Arab proverb said, "He that fears not the Boghaz fears not God."

But in modern warfare the Gates is not the important point. It can be swept from end to end by cannon from the open ground to the north, while on their side the defenders of Cilicia would be involved in several difficulties which it is unnecessary to describe.

When in 1839 the boundary between the Ottoman and the Egyptian power was fixed at Ak-Keupreu, a point in the pass 20 miles north of the Gates, Ibrahim Pasha (or rather his chief engineer, a Pole, Colonel Schultz, also called Yusuf Agha) had to select a line of defence. At first historical tradition made them try the north front of the Gates; but they soon abandoned this scheme,* and selected the Tekir summit. This little open, stony plateau, about 1 mile by 2 miles, offered an excellent position. The approach from the north is up a steep and narrow defile, down which a stream runs east-north-east to the Vale of Bozanti. The defensive works consisted (as Langlois and Ainsworth are agreed) of eight forts, running obliquely across the plateau from east-south-east to west-north-west, presenting a front of about $2\frac{1}{2}$ miles, and mounting over a hundred guns. On the east and west the plateau is shut in by hills of moderate elevation, and a watch-tower was placed on the eastern hills, and a blockhouse on the western. The lines could be held (according to Langlois) by a force of 3000 men.

As the approach from the north was up a narrow glen, the fire of all the forts could be concentrated on the mouth of the glen. Other points of military interest are described by Ainsworth (a traveller commissioned by this Society) and by Langlois. But our interest lies mainly in the conditions which alter the points of importance at different periods of history. The summit was of little consequence in the ancient defensive system, whereas it is the prime point in the modern system. The summit required an army to hold it, whereas in ancient times, when few soldiers were maintained permanently, points of defence were sought that could be held by very small bodies of untrained men. In the ancient system either the top of the narrow glen leading down north to the Vale of Bozanti or the Gates was the point on which the defence would rest; and the north glen offered more opportunity for flank attack on the defending posts, and needed a larger body of defenders, so that the Gates was the point of defence and the boundary between tribes or provinces. The Gates alone was preserved in the memory of history. In modern time the summit is the inevitable line of defence.

Accordingly, ancient history attaches no importance to the Tekir

* Langlois says that the scheme was put in operation to some extent, and found impracticable.

plateau. Langlois, indeed, considers Tekir to be the place called the Camp of Cyrus; but this is certainly an error, as an incident of Alexander's southward march clearly proves. There was a night march of some distance from the Camp before the attacking party (led by Alexander the Great in person) came in sight of the Gates and saw that they were undefended, whereas at Tekir the whole camp would practically be in sight of the Gates. There are also other reasons which prove that the Vale of Bozanti was the Camp of Cyrus; and the inevitable rendezvous for an army preparing to force the Gates.

So hastily did Ibrahim evacuate Cilicia in 1840 that all his cannon are said to have been left on the forts of Tekir.* The eastern fort is still a striking feature in the landscape; but the forts have long ago been dismantled, the guns removed, and the buildings left to moulder gradually away, under the gentle influences of nature, like most things in Turkey.

VII. The Vale of Bozanti (Podandos).

In descending the glen described above as leading down to the Vale of Bozanti, the road is bordered on the right by the Anasha-Dagh, 6000 feet in height. The road which leads down that narrow glen from the Tekir summit keeps to the west bank of a small stream which rises close behind Ibrahim Pasha's lines; but between 65 and 66 kilometres from Tarsus it crosses to the right bank and reaches Aiva-Bey-Khan. The descent is extremely steep for more than 2 miles before reaching this khan. Immediately after leaving the khan the road crosses again to the left bank of the stream, then leaves it 3 miles further on, and goes over some hills, rising 200 feet, and again descending to the Vale of Podandos, still called Bozanti.†

High on the mountain, overlooking the Vale of Bozanti (Podandos), is Anasha-Kalesi, described by Langlois as a Byzantine fortress, built of black marble. Its wonderful situation, and Langlois's account of the material, make it seem more like a castle of the Arabian Nights than a real fortress. Its history can be traced from the eighth century onwards. It was called by the Arabs Hisn Assakaliba, the Sclavonian castle, because a garrison of Sclavonians was planted on those mountain slopes and glens. These seem to have been the Sclavonians who deserted by thousands from the Byzantine side in the seventh century. In the eighth and ninth centuries the castle was taken and retaken

* My estimate of the height of Tekir summit was 4240 (allowing it 80 feet above Tekir Khan) in 1891, and 4300 in 1902. Major Bennet and Colonel Stewart (who was afterwards with Gordon in Khartum) agree in allowing 4300; Ainsworth has 3812; Oberhummer 4607 (with the same allowance as in my estimate). My estimates depend on aneroids lent by the Society.

† There must have been an ancient by-form Pozandos. Compare Nadiandos-Nazianzos ('Hist. Geogr.,' p. 348), Ariandos-Arianzos, etc.

several times, but on the whole seems to have been generally held by the Saracens.

The Byzantine name for it was apparently Rodentos, and the crusaders mixed up the two names, Rodentos and Podandos, and called it Butrentum.* The numerous crosses, marked by many good crusaders on the rocks near the castle, are an interesting monument of those wonderful marches of the early crusades. They are described by Langlois; I have not seen them.

Even the most hearty opponent of epigraphy must feel some interest in those memorials, among which it is possible that Godfrey and Tancred, Baldwin and Bohemund,† inscribed their marks, and must surely regret that those heroes were unable or unwilling to write their own names. The common mercenary soldiers—Greek or Carian—who marched in the service of an Egyptian king to the southern frontier of Egypt, six centuries B.C., could scrawl their names and a record of their march and its purpose as they passed by Abu-Simbel, each in his own language; but few of the nobles of France or Germany could do so eleven centuries after Christ.

The Vale of Podandos is described contemptuously by the great Cappadocian churchman, Basil of Cæsareia, as a mere pit or barathrum in Mount Taurus, which illustrates the indifference of the ancients to the picturesque aspect of nature and their dislike for mountains. Round it on every side the mountains stand up steep to the height of 5000 to 7000 feet above the sea. The Vale itself, which is about 4 miles long and 2 broad, is level, oval in shape, abundantly supplied with good water, and about 2750 feet above the sea. It is the natural rendezvous for an army marching from the interior to force the passage either to Tarsus or to Adana. Here Cyrus the Younger encamped when Xenophon and the Ten Thousand Greeks accompanied him in his attempt to seize the crown of Persia, and the place retained long the name of the "Camp of Cyrus." At present there is only the scantiest population in the neighbourhood—a few scattered huts and small villages or yailas among the mountains, and some nomads' tents and two khans in the valley. But in ancient times the beautiful and fertile Vale, where three routes from the north and two from the south met, must have been a populous and busy settlement.

The stream which comes down from Tekir enters the Vale some way to the right of the road, and joins the river that flows southward

* Constantine Porphyrogenitus distinguishes Rodentos and Podandos, mentioning both, along with Loulon, as the southern points of the Cappadocian Theme. I wrongly supposed in *Historical Geography*, p. 352, that this was an error of Constantine's, and that Rodentos and Podandos were one place.

† The routes of the First Crusade are obscure and deserve fuller study; but Baldwin and Tancred at least must have traversed the Gates, as they took Tarsus and Mopsouestia.

through the Vale. This river, which is called Bozanti Su or Chakut Su, rises on the Central Plateau and flows in a general south-easterly course through Taurus to join the Sarus some miles below Adana. Our road meets it here, and will follow its course upward from this point to the source of one of its arms; but its course downwards to the Sarus may be briefly noticed at this point.

The river flows off to the south-east from the Vale, and a path leading to Adana goes along its bank. After a few miles the rocks close in on the river and narrow its bed, so that the road has to leave it and ascend the mountain-side. The bed of the stream grows more narrow and difficult. Colonel Massy traced its course for a certain

FIG. 3.—THE VALE OF PODANDUS (BOZANTI).

distance, till he could go no further except in the river-bed, and I do not know that any one, except the engineers surveying for the Anatolian Railway extension, have followed it further. They report (as Colonel Massy informed me) that the mountain closes in over the river, which flows into a hole and disappears. This mountain is evidently the same front ridge of Taurus which a little further west was surmounted at Tekir by the Cilician Gates road. The river emerges on the other side, but I could learn nothing as to its exit, or the exact length of its underground course: this cannot, however, be very long, as the road from Adana to Sarishek follows the lower course of the Chakut for a considerable distance, and above that its course is known by report for a good many miles further. Moreover, the river bears the same name below as above, and in similar cases where the

underground course is long, I have always found that the name is changed, even though the connection of the upper and lower streams is firmly believed in by the people.

Obviously, nature marks out the path from the Central Plateau to the Cilician Plain as being down the Chakut to Adana; and the railway will doubtless take that course, if it can elude the one serious difficulty by a tunnel. But the road has to go over the mountain, and the ascent and descent are said by Colonel Massy to be much more precipitous than on the Gates route. It must, however, be remembered that the latter road represents the result of several thousand years' fitful work, and that Greek and Roman and modern European engineers have all laboured to improve it. But this Chakut road direct to Adana (which was said by the natives at Bozanti in 1891 to be an easy path) has been very much left to nature; and the fact that it is now far inferior to the Gates route is no proof that it might not have been made equally good by care and energy.

The question remains for settlement—it is one that I had proposed to myself for the journey of 1902, but found that there was little hope of settling it without a long period of work and a different equipment *—whether any traces can be found of an ancient road down to Adana along the stream. I am for the present reduced to reasoning, which is less satisfactory and convincing than actual discovery.

When Mallos, with the aid of Adana, was competing with Tarsus in early times for the Cilician trade, this natural line of road down the stream from the plateau to Adana must inevitably have been used. But when Tarsian energy had developed the less obvious route through the Gates, and made the magnificent harbour, Tarsus became the unquestioned capital of the lower valley, while Adana apparently allowed the Chakut route to remain unimproved, till it sank into insignificance. Yet it was used as late as B.C. 401, when Cyrus the Younger evidently entered Cilicia by this way.

Xenophon's description of the crossing of Taurus has always been a riddle, but the solution is now quite simple. The soldiers of Cyrus advanced from Tyana, which lies on the plateau in front of the northern end of the Great Pass. As King Syennesis of Tarsus was said to be on the heights guarding the pass, they remained one day in the plain. By the "plain" Xenophon means the Vale of Bozanti, for, though he had been among the mountains for a considerable time before reaching the Vale, yet the march from Tyana to Bozanti is entirely (except for the crossing of one ridge below Lulon) along a level easy path, with a

* Such an exploration may, by good luck, be achieved in a few days, if one chances on some decisive trace; but, on the other hand, the traces of an ancient road often lie concealed close at hand and escape notice: hence it may take a long time to prove a negative.

very gentle rise from Tyana for nearly 20 miles, and then a long gentle descent to Bozanti.

The pass which Syennesis was guarding was clearly the Gates, because it was a road practicable for wheeled traffic; and it seems at first natural to suppose that Cyrus advanced by the same road, for a messenger came to report to him that Syennesis had abandoned the heights; and thereafter the army of Cyrus ascended the heights, and saw the tents where the Cilicians were keeping guard, though we have just previously been informed that Syennesis had abandoned the heights. It is noteworthy that Xenophon at this point speaks only of the heights, and not of the Gates. Had he seen them, he would hardly have spoken so much about the heights, *i.e.* the summit, and kept absolute silence about the critical point which was guarded. Considering how apt and well chosen are Xenophon's brief accounts of what he saw on the march, it seems incredible that he could have described the pass of the Gates in terms so inapplicable, if he had ever seen it. Other travellers, especially Kinneir, have remarked on the unsuitability of his account to the localities. That acute observer, Kinneir, felt convinced that Cyrus did not traverse the Gates, but frankly confesses that he cannot specify the route. He finally takes refuge in the supposition that Xenophon may have forgotten; but we shall find this unnecessary.

Of course, those who are determined to make out that everything in the ancient writers is perfectly accurate and perfectly in accordance with our present knowledge (however inaccurate our present knowledge may afterwards turn out to be)—all that large class of scholars will easily find that Xenophon is here describing the Cilician Gates, when, without mentioning the one really important and impressive point, he tells how the army climbed the heights, and looked on the Cilician tents, and then descended the other side.

But the decisive proof that Xenophon did not cross through the Cilician Gates lies in the fact that he descended into a large and beautiful plain, and thereafter marched four days' journey (25 parasangs, *i.e.* 62 or 63 miles) through the plain to Tarsus.*

Contrast this with the account of Alexander the Great's march. He halted at the Camp of Cyrus, *i.e.* in the Vale of Bozanti. Then during the night he advanced with some chosen troops to surprise the Gates. The guards at the Gates, seeing him advancing over the summit, abandoned their post and fled. They knew that there were other paths across the mountain wall, and were afraid that they might be taken in rear. Thereafter Alexander occupied the Gates with his whole army, and in one day swooped down on Tarsus, about 34 Roman miles, downhill the whole way—a good march, but quite possible.

* This seems decisive against Sir C. Wilson's suggestion, otherwise very tempting, that Xenophon crossed the ridge by the path above the Gates mentioned in Section VI.

Xenophon describes the march from Tyana to Tarsus as being through the plain for some considerable distance, then across a mountain, and then for over 60 miles to Tarsus through the plain. This is true of the Chakut route if we bear in mind that both on the north and south he speaks of a road along an easy, very gently sloping glen as being "through the plain." It is remarkable that Xenophon states time and distance in every march across Asia Minor except the one from Tyana through the plain (*i.e.* to the Camp of Cyrus) and across the mountain ridge; but it is quite characteristic of the ancient style to omit some numbers in this puzzling way, as every reader of the Acts of the Apostles knows. The march, being a dangerous one, was probably made slowly and with frequent halts.

Obviously, Xenophon's 62 miles from the foot of the mountains to Tarsus is wholly inconsistent with a passage of the Gates; but it suits quite well with the route that goes down the Chakut water. Cyrus climbed the mountain, where the stream goes under it, descended the other side, and was then obliged to follow the river for some distance, and at last turn away south-west to Tarsus. In this way he would have about 60 miles' march to Tarsus after he had descended into the low ground from the mountain.

Our conclusion seems irresistible. One way of eluding it is to suppose, as some have done, that Xenophon means that the whole march from Tyana to Tarsus was 62 miles. But that is impossible, both because the meaning of the words is quite plain, and because the distance from Tyana to Tarsus by the shortest road is fully 95 miles.

Xenophon made one mistake. He was at this time an obscure volunteer, who had not access to the best information, and he thought that Syennesis had been defending the route by which the Greeks advanced, and hence he says that the king had been defending the heights; but there can be no doubt that the main Cilician defence rested on the Gates, 500 feet below the summit of the road. But, even though the Cilician king had abandoned the Gates, Cyrus shrank from attempting that road. The pass below the Gates was difficult, resistance was possible at several points, and Cyrus evidently desired to occupy Cilicia peaceably, relying on the co-operation of the Cilician queen.

Apart from that one misconception Xenophon's account is clear and simple, in keeping with the directness and accuracy of his whole narrative.

The history of Podandos was wholly governed by geographical considerations. It was naturally a place of great importance in the Roman Empire, as the maintenance of communication along the great Cilician and Syrian road depended on it. In the strange mixture of royal governments and Roman provincial boundaries that characterized the first century after Christ, the maintenance of Roman communication

between the provinces by retaining command of the Great Pass was a prime necessity; and the command of the Pass depends on the possession of Podandos.

Yet, to judge from the books, Podandos was at that time the most insignificant of places, never requiring to be mentioned. But its situation, while ensuring a distinct importance for it as an administrative centre for the Taurus district,* and as a centre of communication at the meeting of four roads (perhaps even of five †), was also so confined as to prevent all possibility of great development. Moreover, it evidently suffered from the foundation of the city and Roman colony Faustinopolis,‡ 25 miles north-west, on the same Great Pass. It may be presumed that the new city enjoyed imperial favour; and its situation made it a better centre for the northern Taurus district than Podandos.

When in A.D. 372 the Emperor Valens divided the huge Province Cappadocia into two parts, Prima the northern and Secunda the southern, Cæsareia continued to be capital of the northern part, and Podandos was chosen as capital of the southern part. There can be no doubt that the choice was due to its importance as a centre of communication; but the choice was vehemently resented in the country, and strenuously opposed by Basil, who describes Podandos as like "the Spartan pit Ceadas (into which criminals were thrown), or one of those natural chasms breathing a noxious vapour, to which people have given the name Charonian." The issue finally was that Tyana was made the metropolis of Second Cappadocia.

The bishoprics of Cappadocia Secunda now ceased to be subject to Cæsareia. This change also was vehemently resisted by Basil; but in vain. He instituted several new bishoprics to strengthen himself, and one of them apparently was Podandos. Podandos was obviously a part of the Province Secunda which contained the southern half of Cappadocia, yet Basil seems to have succeeded in maintaining the ecclesiastical relation between Cæsareia and Podandos, though the civil administration must still have regarded Podandos as part of Secunda. Basil was aided by two circumstances to maintain the ecclesiastical relation contrary to the civil. (1) There was a road, practicable for horses but probably not for carriages, which connected Podandos directly with Cæsareia without passing through Tyana, as the great route did. This road diverges from the great route at Podandos and goes straight north,

* Taurus, really an elevated broad plateau rather than a mountain range, presents, even in this very broken part, many high-lying glens and open places which were once much more populous than they are now.

† These are (1) by the Gates to Tarsus, (2) to Adana, (3) to Cæsareia direct by Karydion or Funduklu, (4) to Tyana and to Heracleia by Loulon—the road which is the object of this study, (5) a horse-road to Tyana diverging from (4) at Takhta-Keupreu (see below).

‡ See Section IX.

keeping high up on the east flanks of the lofty mountains called now Ala-Dagh (a long and striking ridge, covered with eternal snow * all along its jagged summit, said to be 11,000 feet high, running like a great wall from south to north, a projection from the Taurus range, but diverging much from the line of that range). This road has been much used in recent centuries for such traffic as was carried from Cilicia to Cæsareia, because the longer Roman route had sunk into such a state of disrepair as to be passable only by pack-animals; and it is probably the route called Karydion in Byzantine times. That view seems to be proved by the name Funduklu, still attached to a village on the road.† That being so, the glen by which our road leaves the Vale of Podandos and goes on to the west or north-west, is the Byzantine Maurianon (see 'Historical Geography of Asia Minor,' p. 350). (2) The see of Cæsareia owned the revenues of the monastery of Orestes, which was apparently somewhere in the neighbourhood of Podandos, and this connection strengthened the ecclesiastical bond.

Hierocles, who was much influenced by the ecclesiastical lists, was betrayed by them into the error of placing Podandos among the cities of Cappadocia Prima, though there can be no doubt that the whilome civil capital of Secunda must have been ranked by the civil authority in that province; and Hierocles aimed at constructing a list of civil, not ecclesiastical, character.

In later Byzantine time Podandos was separated from Cappadocia and transferred to Cilicia. This implies that the Cilician frontier was pushed north from the Gates for some distance; and it is probable that the new frontier was fixed at the narrows immediately west of Chifte-Khan, though a point nearer White-Bridge is possible (see below). The time when this change was made is uncertain. It was later than Hierocles (about A.D. 530); and it is not likely to have been made except as part of some general reconstruction. When the Themes were instituted, probably by the Iconoclast emperors in the eighth century, Podandos was still connected with Cappadocia, of which Theme Constantine Porphyrogenitus says that it formed the southern limit.

The transference, therefore, had not been made before the Arab conquest of Cilicia about 650; and, if so, it is not likely to have been made until Tarsus and Cilicia were recaptured from the Arabs in 965; for it would be absurd to place a town, which was in dispute between

* Mr. Hogarth informs me that he does not believe the snow lies all through the summer on Ala-Dagh. There has always been snow on it and on Hassan-Dagh (said to be lower by nearly 1000 feet), so far as my experience (insufficient to prove the point) goes; and the popular story is that Ala-Dagh is always snow-clad.

† The name Funduk is found also as an Oriental form of the Greek *Pandocheion*, "an inn" (see Buhl in Hastings, 'Dict. of Bible,' V., art. on *Roads and Travels in O.T.*; Krauss, 'Griech u. Lat. Lehnwörter im Talmud,' etc., ii. p. 428; Neubauer, 'Géogr. du Talmud,' p. 172); but that form is not likely to have occurred in this case. Funduk is the Turkish translation of the Greek *Karydion*.

Byzantine and Saracen armies, under the authority of Tarsus, which was definitely a Saracen city. On the other hand, it is only natural that, when Tarsus was recovered, the long-disputed line of the great road, which had become so closely associated with the long-lost city, should be formally placed under its authority; and so we find the bishopric of Podandos under Tarsus in a very late Oriental Notitia.*

VIII. From Bozanti to the Vale of Lulon.

The road keeps on to the north through the Vale of Bozanti, past two khans, and turns to the north-west along the right bank of the Chakut, through a glen which grows narrower as we ascend. South of the point where the glen opens on the vale, the ancient Podandus may be placed. Past the 80-kilometre stone we cross a bridge, called Ak-Keupreu ("White Bridge"), which is the boundary of the vilayets of Adana and Konia, and which was formerly the boundary between Turkey and Ibrahim Pasha's realm. When Ainsworth passed along this road in November, 1839, the advanced guard-houses on the Egyptian side were placed at the point where the glen opens on the Vale of Bozanti, while the main line of defence on the Tekir plateau has been described above. The Turkish advanced posts were close to the west of the White Bridge, and their main lines at Chifte-Khan, about 8 miles further up the glen.

The Ibrahim legend is here again in evidence. Already in 1839 Ainsworth says that the White Bridge was built by Ibrahim Pasha, but this is incorrect. The bridge, as we saw it in 1882, 1890, and 1891, was evidently a mediæval work, and quite picturesque, with its steep ascent to a high central point and its sharp descent on the other side. It was very narrow, about 7 or 8 feet across. Ibrahim's bridges were not of that style. But, naturally, he was not eager to facilitate the passage across his frontier, and left the old bridge, which Captain Macdonald Kinneir saw in 1813.

White Bridge is placed at the narrow end of a funnel. The rocky hills north and south of the stream here close in till they nearly meet, and there are few spots more picturesque than the approach to the bridge from the Vale of Bozanti. The old White Bridge, too, was suited to its surroundings; but between our visits in 1891 and 1902 it was replaced by a much more commodious and less picturesque structure, and is now a broad level viaduct, approached by high embankments on each side. The southern approach has completely covered up and destroyed the beauty of two springs, which rise under the rocks close to the bridge on the left hand as we ascend the stream. One was about 20 yards below the bridge, and the other close to the southern end of

* The published *Notitiæ Episcopatuum* as a rule are confined to the Patriarchate of Constantinople, and therefore omit all Cilicia, Syria, Palestine, etc.

the bridge. The latter, called Sheker Bunar ("Sugar Spring"), now runs out through a small tunnel in the substructure of the bridge. The rocks have been blasted along this stretch of road, which was formerly difficult; and the lower spring, which was formerly extremely picturesque, is now unrecognizable; and both might readily be passed unobserved by travellers.

Above the bridge another very large spring, called Kara-Su ("The Black Water"), rises under the southern mountains. The story is that this spring, whose water is bad and fever-producing, comes from the Bulghar Maden (Mines), so that straw thrown in at the mines comes forth by this spring, and that it poisons the waters of the Chakut-Su.

FIG. 4.—LOOKING UP TOWARDS WHITE BRIDGE: RUINED OLD BRIDGE.

This spring was called Rakha by the Arabs; and the belief in its poisonous character can be traced as far back as the ninth century, when the death of the Khalif Al-Mamun was attributed to this cause. The story is told by the Arab historian as follows:—

Returning in A.D. 883 from an expedition into the Byzantine territory, the Khalif Mamun encamped by the side of the beautiful stream, whose waters were so clear that the legend on a silver coin, which was thrown in, could be read as it lay at the bottom, and so cold that it was impossible to bathe in them. Mamun saw a fine fish in the water, and promised a reward to the man who should bring it to him. A servant caught it, but as he was handing it to the Khalif, the fish slipped out of his hand back into the stream, and splashed the ice-cold water over the royal robes. The fish was again caught; but hardly

had the order been given that it should be fried, when the Khalif was seized with a chill, and began to tremble like a leaf. His attendants covered him with garments, and lit a fire; but he continued to complain of the cold, and when the fish was brought cooked to him he could not eat it. He asked the name of the stream: it was called Koshaira, "stretch out thy feet." He asked the name of the district: it was called Rakha. Then he remembered the prophecy that he was to die at a place called Rakha, on which account he had always avoided the city of that name. That night he died; and Mutassem, his brother, reigned in his stead, and carried his body to Tarsus and buried it there.

There is here an evident confusion of the two springs, the beautiful

FIG. 5.—LOOKING DOWN TOWARDS WHITE BRIDGE.

water below the bridge, and the immense volume of water above it. Ainsworth notices only the sweet spring; while Kinneir draws a striking picture of the large upper spring, and has nothing to say of the lower springs. He says that the "torrent bursts from an abyss in a manner most extraordinary, and containing a mass of water equally great as the Seihun" (the name which he wrongly applies to the Chakut-Su, which is only a tributary of the Seihun). Now, Kinneir saw the Chakut in flood, enlarged by many tributary torrents that poured down the sides of the mountains in the gorge. Langlois also speaks only of the Kara-Su ("the Dark, Mighty Water"). The accounts of these travellers, apparently irreconcilable with one another, really relate to different springs, yet all declare that there is only one.

At the north end of the White Bridge a new khan has been built in the last few years, which is, if possible, dirtier and more miserable than the old khans on this route. The line of the Roman road can be traced very clearly beside and below the khan. It did not cross at the White Bridge, but ran along the left or north bank till at least 500 yards further down. Much cutting was needed to make room for it on this bank, and three gateways have been cut through projecting spurs of rock, varying in breadth from 13 to 15 feet. At the left as one enters * on the first gateway is an obliterated inscription, which we examined with eager curiosity in hope of some historical evidence; but after some trouble found it to be only a pious expression, "Lord, help Martyrius, the deacon," engraved in good letters of the early Byzantine or late Roman period—perhaps the prayer of some pilgrim to Jerusalem along this pilgrims' road.

Below this first gate is the ruin of an older and even narrower bridge than the old Ak-Keupreu; it was clearly a mediæval work.† Of the Roman bridge we saw no trace, though we walked down along the Roman road to the end of the rocks. The Roman bridge was situated in an open part of the glen, and has been entirely carried away by the storms and floods of a thousand years. Here, as further south, the Roman road was on a high level, and there must have been an elaborate substructure to carry it along in many parts; only where the rock level was high can we still trace the line.

But more than nature was at work to destroy the Roman road. This was the road by which the Arab armies came to harry the Byzantine province and to besiege Constantinople itself, and there can be no doubt that difficulties were thrown in their way by destroying the grand Roman road. But as to this we are not left to mere reasoning; we have the definite proof in Ibn Khordadhbeh's account of the road about the middle of the ninth century.

"After leaving Podandos one travels through a narrow pass, called the Two Clefts (*les deux fentes*),‡ traversed by a river which one has to ford twenty times, to the hot springs, which are separated from Louloua by an easily crossed hill. After crossing this ridge, Louloua lies in front. Thence one goes to a castle" (evidently Hirakla, near Eregli, which preserves the name).

The Roman road kept on the north bank the whole length of this glen, and must have been completely destroyed before the path could be forced to cross and recross the stream so often.

The sides of the gorge above the White Bridge close in more

* I mean from our view as we walked back down the glen after crossing White Bridge, tracing the line of the Roman road.

† It can be seen in Fig. 4, on the north bank.

‡ The name still lingers in Chifte ("Twin") Khan, at the upper end of this part of the pass.

narrowly, and this is, on the whole, the most picturesque and magnificent part of the whole route. On the south the mountain rises practically perpendicular, to the height of quite 1000 feet. I should guess even a greater height, and should add that for a long distance it looks as if a stone dropped over the top would fall clear down to the bank of the stream without touching the rocks; but in such matters the eye is a fallible witness. The plants and moss in the crannies of the rock impart a strikingly beautiful variety to the colouring, in some seasons of the year at least; but even this colouring does not detract from the awe-inspiring character of that vast almost overhanging wall. On the north side the hills rise nearly as high, but slope more gradually,

FIG. 6.—ROMAN ROAD CUTTING, WIDENED BY BLASTING TO TAKE MODERN ROAD.

and as the road keeps close to this bank the whole way, and the path has been in many places blasted by modern or cut by Roman hands out of the face of the hill, one does not get the same impression of a towering precipice as on the south side.

The road from White Bridge onwards, which was exceedingly bad in 1891, is now excellent, almost as good as a Swiss diligence road in the Alps.

Two minutes after White Bridge we observed the 85-kilometre stone from Nigde, implying that White Bridge is about 85¼ kilometres distant from that city, the modern capital of this region or Sanjak (*lit.* Standard) of Konia Vilayet. Nigde is about 12 miles beyond Tyana, and henceforth for convenience we shall mention the miles from Tyana (here XLV.).

Four minutes after White Bridge there is a good deal both of Roman cutting and of modern blasting of the rock, and the two processes are here very clearly contrasted (see Fig. 6).

At 80½ kilometres (XLII. Tyana) we cross at Takhta-Keupreu ("Wooden Bridge") a stream coming in from the north. This stream rises in a great number of rivulets far up to the north-west, on the edge of the Tyana plain, and the horse-road to Tyana and Nigde goes up its course. This road must have been an important one in the Saracen wars, as offering an alternative route to Tyana and the river country, and avoiding the strong castle of Lulon, when that fortress was in Byzantine hands.*

The view was long held that this path up the Takhta-Keupreu water was the line of the Roman road to Tyana, and my 'Historical Geography' (p. 346) † was written under that misapprehension. The true route was discovered on our journeys of 1890,‡ after the book was printed, but before it was actually published. The Roman road, whether to Tyana or to the west direct by Herakleia-Cybistra, keeps straight up the glen which we are ascending; this path, though a little longer, is much easier.

About the 77-kilometre stone (XL. Tyana), a road goes off right to the Hamam ("Hot Baths"), and nearly a kilometre further on we cross the water that comes down from the Baths. Ainsworth tried to quench his thirst with this water, and found it warm. But even if I ever broke the rule not to drink on the march, the sight of the Hamam, on a visit which we paid to it in 1882, would have for ever prevented me from drinking of that stream. The establishment is now of the most wretched character, and presented a singular contrast to the stately building which is figured by the roadside on the old Roman road map called the Peutinger Table. It lies only a few hundred yards back from the main road, though not within sight of it, in a recess of the mountains; and we observed no trace of ancient work. After the 75-kilometre stone (XXXVIII. Tyana), the road from the Baths westwards joins us, and soon afterwards we reached Chifte-Khan, "the Khan of the Twin Clefts." Between 75 and 69 we saw no kilometre-stones;

* It is not impossible that this may be the Karydion route, though, for the reasons already given, that route is more probably to be identified with the path leading straight north from Bozanti.

† The only change needed in p. 346 is to read Ulu-Kishla in place of Pashmakji. In pp. 351–354, where the subject is more elaborately discussed, no topographical alteration is needed (except that Weil's identification of Assakaliba as the Arab name for the castle of Lulon must be deleted (see Section VII. for the correct view)). The conclusions about Lulon, Faustinopolis, and Halala, there attained by a long argument of only probable kind, are now conclusively proved (see Section IX.).

‡ I traversed this route for the first time in that year; and my companions, Mr. Hogarth and Mr. Headlam, found two milestones on it. In 1902 my wife and I found a third.

this was unfortunate, as our time suggests that the Turkish measurement is not accurate here.*

At Chifte-Khan a stream from south-west comes down a most beautiful glen and joins the main stream. This stream flows from Bulghar-Maden (mines of argentiferous lead), past the village of Ali-Hoja.† The meeting of the two streams has suggested the name, which means "Twin-Khan." The pass has been more open for the last mile, and the meeting of the two streams makes a charming little valley.

Ainsworth, in 1839, saw the main Turkish lines defending the pass

FIG. 7.—TWIN-KHAN (LOOKING UP BULGHAR-MADEN WATER.)

at this point. They were a poor contrast to the really strong works of Ibrahim Pasha on the summit of Tekir.

Immediately behind Twin-Khan the southern hills close in and narrow the glen, and the modern road follows the course of the stream, to the south bank of which we cross beside the khan. The road then ascends a fairly steep slope, but is well planned and well built. I took no reading at Twin-Khan, but estimate the altitude as 3240 feet. Twenty minutes beyond it the altitude was 3600 feet, and

* We went from 75th to 69th stones in twenty-two minutes; though we drove very fast along the good road to Twin-Khan, this rate seems incredible, especially as we walked on foot up the ascent west of the Khan. I suspect that the measurements were made by the longer path over Giaour Sindikh (see below), and left unchanged when the shorter way through the gorge was built.

† Called Alaguga by Ainsworth.

the stream there was far below us out of sight: the rock sloped down from our road till it almost met the sloping rocks of the north bank: there remained between them a narrow chasm, cut as with a knife—so narrow that, to us far above, it looked not more than 8 or 10 feet across—and far down at the bottom of that chasm the stream made its stormy passage.

Immediately after the 68-kilometre stone (XXXIII. Tyana) there is a narrow old bridge at a lower level spanning the chasm, which here is broader. The older horse-road used to cross here from the south bank to the north. The modern road keeps the south bank for a kilometre further, when it crosses by a new bridge (elevation 3630 feet). Just before this bridge there is a break on the north side where Kochak Dere comes in. In this part there is a little green with some trees and grass; but otherwise all this gorge from Chifte-Khan to Giaour Sindikh, 4 miles long, is absolutely desolate, bare rock, without a plant or a blade of grass visible, in striking contrast to the beauty of the Vale of Chifte-Khan.

The new road through this sterile gorge is exceedingly well built, and must have been very expensive; but, of course, the work is done by forced labour, on an admirable and perfectly humane system, every man being assessed a week's labour in the year, which is applied on the roads in his own district. This assessment is the least burdensome and most productive method of taxing a poor and hardy population, whereas even a very small tax in money would be felt oppressive, and more than half of the amount paid would be diverted to the pockets of officials, while most of the rest would in other ways fail to be applied to the road-making.

A road like this is one of the occasional signs which cheer the traveller in Turkey with the assurance that the country has still much latent strength. Anatolia has long been the seat of vitality of the Turkish State, and it is so still.

In general, I may say that on this journey we were more struck than ever before in Anatolia with the obvious signs of prosperity and increase in the population; and this was not in a region where the railway had come, bringing some activity and energy, but in simple and pure Turkish land. The excellent harvest of the preceding year had something to do with the appearance of prosperity; but that would not explain the increase in the number of villages and the breaking up of new ground, with which we were impressed since we traversed the same country, though as far as possible on a different line, eleven years previously.

The reason lies to a great extent in the administration of the present Vali of Konia, Ferid Pasha,* a man who possesses the governing

* He is now Grand Vizier; but the above was in print before his promotion occurred

instinct and capacity, who has learned much from modern European method, but applies what he has learned, not with the rigidity of a mere official trying to force European ways on an untrained, undeveloped, and unresponsive Oriental race, but with the free, rough-and-ready natural power of one who sees what is possible and gets his work done in a way that the people are fit for. Hence, on the one hand, as I was told, he has greatly increased the revenues which the Vilayet sends to Constantinople, and, on the other hand, I can vouch

FIG. 8.—OLD BRIDGE IN THE GORGE BELOW LULON.

from personal experience for the fact that the increase is accompanied by obvious signs of increased prosperity among them, and by the most perfect order and quiet. During the last two years we travelled widely in the Vilayet, and found not the slightest trace of disorder, such as we have often observed in previous years in that and in other parts of the country. Such is always the case, in our experience, when a capable man is in authority: within two or three months the influence of a strong will and the steady pressure of a firm hand are apparent

from end to end of his province, and you can travel with as little fear of trouble or danger as in the most orderly country of Europe. But, when you inquire into the origin of the administrator, you will find that he is either an Albanian, like Ferid and the other great ruler whom I have previously mentioned, or belongs to some other of the races that possess the governing faculty. The surgeon's knife is much needed in Turkey, provided it be applied with judgment; but perhaps there are few countries in Europe where it might not be applied with benefit to the national health.

The hills between Chifte-Khan and Giaour-Sindikh are the ridge, which Ibn Khordadhbeh describes as "easy to cross." By this he can hardly mean that it was easy in comparison with the road which he has been describing immediately before, between Bozanti and Chifte-Khan; for, however much that stretch of road might have been broken in order to delay the passage of invading armies, it could hardly have been made so bad as the hill road necessarily was. The Arab geographer is speaking as a soldier who had often made the march, and his meaning probably is that an army had less need to fear opposition on those comparatively open hill slopes than at other parts of the Great Pass. The gorge would in itself be easily defended; but the hills on the south are hardly more difficult than the gorge, and therefore the defenders' position in the gorge would be untenable. But along the rest of the Great Pass it was rarely possible to go round the flank of an opposing force, and the road must be won by direct attack if an enemy barred the way.

Just where the gorge begins to open a little there is an old bridge about the 64-kilometre stone (XXX. Tyana). Here the earlier araba road crossed from the south side of the stream and joined our present road. This old araba road ascended the hill from Chifte-Khan, keeping a line some way south of the gorge, and at last descended, by a very steep and difficult path, down a series of broad natural steps, to the south bank of the stream, beside the bridge. This gigantic staircase is called the Giaour-Sindikh. The bridge is about 4100 feet above the sea, showing a considerable rise from Chifte-Khan. Here ends the ridge alluded to by Ibn Khordadhbeh as lying before Lulon.

IX. The Vale of Lulon, and the Camp of the Roman King.

The glen now opens gradually as we advance, but is still very bleak. After passing the 63-kilometre stone we reach Tossun Ali, or Tossun-Khan, and beyond 61-kilometres (where we did not see a stone) is a mill.* Here a more open valley spreads out before us, gentler and

* The name was hesitatingly given as Porsukh-Deirmen, from the nearest village, Porsukh.

tamer in character than the previous part of the pass; the hills here slope gently, and the meadows by the stream are pleasant. The main ridge of Taurus, the Bulghar-Dagh, bounding the southern horizon with its long snow-clad ridge at a considerable distance, now comes into full view for the first time. Previously it could not be well seen, because it was concealed behind the high intermediate mountains. We now see that the vale is formed by the junction of two streams, one coming in from the south-west, bringing the waters of the front slopes of Taurus main ridge, the other being the line of our road, coming down from the west. We learn from Ibn Khordadhbeh, quoted above, that this is the Vale of Lulon. After crossing the ridge, says the Arab geographer, the traveller has Louloua before him. This settles finally a topographical and historical problem of great interest—the situation of the great fortress of Lulon, which was the "bulwark of Tarsus," because, when the Arabs of Tarsus held that fortress, they could prevent a Byzantine army from entering the Great Pass. But Lulon was the watch-tower of the Byzantine Empire when the Christians held it. It was the starting-point in the line of beacon-fires by which news of an Arab raid was telegraphed to Constantinople, until the worthless Emperor Michael (842–857 A.D.), annoyed that his amusements in the amphitheatre were interrupted by the signal, ordered that the practice should be discontinued.

When the fashionable process of whitewashing all the proverbial villains of history is applied to the Byzantine time, it will be pointed out that Michael's act was misrepresented under the dynasty of Basil the Macedonian, who dethroned him; that the Saracen power was sinking low at that time and was no longer a menace to Constantinople; and that therefore it was no longer wise to throw the capital in disorder at every raid, as these could be dealt with by the ordinary armies of Anatolia. But the fact remains that the Arab power was still the great enemy, that peace and prosperity could not be hoped for in the empire until those raids were made impossible, and that Constantinople was only too apt to forget about the provinces and attend only to its immediate interests.

After the 59-kilometre stone (XXVII. Tyana) we pass Cheshmeli-Khan, and between 55 and 54 Dubekji-Khan. Immediately after the 54-kilometre stone (between XXIII. and XXIV. Tyana) the road from the mines of Bulghar Maden to Tyana comes in from the south-east, and a few yards further on is a disused cemetery by the roadside, on the right. In it are three milestones, one of which is marked "XXIII. from Tyana," and another is inscribed with the distance from the Gates. Unfortunately, the latter number is a puzzle; it has the form—

Without entering into the arguments and the difficulties, I may state the conclusions which seem probable and, for the most part, practically certain.

(1) The group of milestones stood together at this point, close to where the roads forked. It was usual to have quite a group of stones at each mile along the roads in this country. But still, most milestones have been carried from their original places, and some proof is demanded in this case. The proof lies in the numbers. The distance XXIII. from Tyana is correct.* The distance from the Gates, according to the Turkish measurements, is 57½ kilometres, *i.e.* XXXVIII. Roman miles.

(2) The distance from Tyana to the Cilician Gates along the modern Turkish road, which necessarily follows the same route as the Roman (for no other is possible),† is about 92 kilometres, and the distance on the Roman road must have been LXI. miles; and, as these milestones are XXIII. from Tyana, they must have been XXXVIII. from the Gates. Hence the number XXXVIA. on the milestone is a slip of the engraver for XXXVIII.; he made the last two lines meet instead of keeping them parallel, being perhaps a Greek workman deceived by a carelessly written copy (as is not uncommon with Latin inscriptions in this country).

(3) The number ϵ means that this is the fifth milestone in the territory of the city which was situated in the Vale of Lulon. One of the milestones gives the name of this city as Colonia Faustiniana, the Roman city founded by the Emperor Marcus Aurelius as a memorial of his wife, Faustina, who died here on a journey through the Great Pass. This stone, then, was the fifth since the road entered the territory of Colonia Faustiniana. The other supposition, that this milestone was the fifth from the Colonia,‡ has been found to be impossible, because the site of the Colonia is certain, and no point 5 miles from it on the road could be XXXVI. or XXXVIII. from the Gates, or XXIII. from Tyana. But the territory of Faustinopolis (as Colonia Faustiniana was called in the Greek speech) is very clearly marked by nature; and the boundary between it and Tyana must have been in the gap on the north through which the road goes to Tyana, about 4 miles distant.

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* In an unpublished article (summarized in the recent Supplement to vol. iii. of the Corpus of Latin Inscriptions), I estimated the distance to Tyana as XXI., according to my own itinerary, and inferred that the milestones had been carried from a point 2 miles away on the east. The Turkish measured kilometres show that the distance to Tyana is XXIII. (53¾ kilometres to Nigde).

† Except that the Roman road probably went across the ridge west of Chifte-Khan by a longer way, south of the gorge, which the new waggon-road follows, and nearer the line of the old waggon-road.

‡ That supposition was followed by me at first, and appears in the Supplement to Corpus and among the topographical identifications which I inserted in the account of this route in Sir C. Wilson's Handbook. It implies that Ulu-Kishla was the site of the Colonia.

(4) The village where Faustina died was called Halala. This village stood near the cemetery of the milestones, and the Vale was the territory that belonged to it; in other words, Halala and Lulon are the same district. This was demonstrated by indirect arguments in my 'Historical Geography,' and from this identity the approximate site of Halala—Faustinopolis—Lulon was deduced. Such identity does not mean that the old Anatolian village, the Roman colony, and the Byzantine fortress all stood on the same spot. It means that they were the centres of population and government selected at different periods for the same tract of country, viz. the vale where we are now standing and the uplands and glens of Taurus, with some rich mines and a considerable population in old times.

The inscriptions prove that the Roman colony was here. The route given by the Arab geographer proves that Lulon was here. The proof is perfect, and to complete the subject it only remains to find the exact sites.

The village can hardly be identified; it would leave too little trace to give certainty, but it was probably at the fork of the roads to Tyana and to Ulu-Kishla, near the modern villages Bey-Aghyl and Porsukh.

As to the others, it is only necessary to bear in mind what was the situation proper, on the one hand to a Roman Colony, and on the other hand to a Byzantine castle in the Saracen wars, and one picks out the sites without hesitation. About half a mile to the south-east is a well-marked little plateau, about 50 to 100 feet above the vale. This plateau is the eastern apex of the hills which divide two streams, coming respectively from south-west and north-west. It has the appearance of having been modified by the hand of man, so as to present a level surface and a steep exterior. It stands close to the Great Road, in a situation very convenient for trade, and yet capable in Roman hands of being made a strong fortress. The old Turk who watches our operations and the strange instruments which we use tells us, when we ask him if there are any remains of antiquity hereabouts, that on that plateau they abound, and that marbles and cut stones have been dug up there. We visited the place in 1891, but owing to the crops growing over the site we could learn nothing from observation; and the same cause made a visit in 1902 useless. Without doubt that is the site of the Roman city and Byzantine bishopric, which was called at first Faustiniana Colonia, but as Latin soon ceased to be spoken by its inhabitants, the Greek name Faustinopolis came into use.

Now we look to the north where a high peak towers about 1000 feet above us, and examine it through our glasses for traces of walls. We can see none, yet this looks an ideal site for a castle such as came into fashion during the Arab wars. At that time the sudden rush of a Saracen raid carried by storm a city like Faustinopolis, ill defended by its peaceful and untrained population, who had lost all

military instinct and capacity, and were an easy prey to the hardy barbarians, whose sole business was war, and whose chief aim was death in battle as the climax of a career of victory. What was needed was a castle on a high peak, where nature aided the garrison to resist the rush of the Arab storming party. Such a fortress, indeed, could be reduced by famine and thirst; but the Arab incursions were in most

FIG. 9.—THE CASTLE OF LULON (FROM THE SOUTH).

cases mere hasty raids, and it was not often that, after the first energy of Saracen attack was spent and Constantinople had three times resisted their long blockades, they were willing to face the severe winter weather of the Central Plateau north of Taurus.

For such a purpose that lofty peak is an ideal situation. The road to Tyana turns north round its base, and thus it commands the road for a long way. Its great height would make it an admirable signal-station: it overlooks the road through the vale to the gorge, and probably even the glen beyond Chifte-Khan, and to the north it must command a magnificent view to the second beacon-height on the lofty western spur of Hassan-Dagh (Argaios). In 1886 I climbed up to that

grand castle on Argaios, and looked down to the peak of Lulon; but in 1902 I felt myself too enervated by the heat and moisture of Cilicia to attempt this steep height. Moreover, a heavy thunderstorm burst over us as we were looking up at the peak. We can hardly be mistaken, however; this must be Lulon.

And so we appeal again to the old Turk; and he tells us that there are great walls and rock-cuttings on the top of that hill, but the walls are chiefly on the north and the west sides.

Further, Ibn Khordadhbeh makes it clear that the Arab name for the great fortress here was Aç-Çafçaf. The situation of Aç-Çafçaf has always been a puzzle, because the Arab writers sometimes speak of Louloua and at other times of Aç-Çafçaf, and this seemed to prove that they were different fortresses. We now see that they are two names, Arab and Byzantine, for one place.

Another kilometre or less brings us to Kartal-Hassan-Khan. The ascent has been comparatively stiff since 56 kilometres, and the glen is narrowing again. After another kilometre we reach the point where the road to Tyana turns up to the north, passes through a gap in the hills, and disappears from view.* We keep on west for 3 miles to Sejah-ed-Din-Ulu-Kishla ("the Long Barracks of Sejah-ed-Din").

Here at Ulu Kishla ends the pass of the Cilician Gates, for the road now enters on an open high-lying valley, nearly circular to view, in diameter about 3 or 4 miles. At the western end of the open valley is the watershed, a gentle elevation about 5440 feet above the sea. The eastern end by Ulu-Kishla is about 4840 feet high. The watershed on the north is about 4900 feet at the point where a road goes off to the Turkmen camps on the plains that lie between Eregli and Tyana. At the western watershed begins a glen leading north-west, which is perhaps the River of Tamarisks of the Arabs (Wâdi, or Nahr-at-Tarfa).

The large building which gives its name to the village, Ulu-Kishla ("the Long Barracks"), belongs to the early Turkish period. It is not a khan, as some travellers call it,† but a station for troops; and its construction must belong to the period when the defence of the pass was still important. The villagers now say it was built by Ibrahim Pasha; but when we derided this statement, a very old man was sent for to decide the question, the sole inhabitant who had survived from Ibrahim's

* In 1890 I came from Tyana by this road, going to Tarsus very hurriedly. It is an easy road, ascending very gently to a barely perceptible watershed which is in the gap in the hills just mentioned. In 1902 we went some distance up the Tyana road in vain search of a kilometre-stone. The railway from Kouia will enter by this path probably, and not by Ulu-Kishlu.

† By a slip very rare in his singularly accurate, but unfortunately too brief, Handbook, Sir C. Wilson calls it a khan. This is literally only a slip, as he pointed out to me in 1882 on the spot that the building was not a khan. But in the preface he says that this route was written by another hand.

time, and he confirmed us, to the great admiration of his compatriots. A mosque, beside the Kishla, however, may be Ibrahim's work, as Sir C. Wilson thinks, and as, if I recollect rightly, the old man declared.

It is tempting to identify the Long Kishla as the site of that Camp of the King of the Romans, which Ibn Khordadhbeh describes as being at the end of the pass; but Kinneir mentions a Roman camp in the narrows near the group of milestones under Lulon, and the possibility must be acknowledged that that was the Camp meant by the Arab geographer.

Had time permitted, I should have liked to say something as to the conditions of weather in the pass, for Taurus marks the limit between the severe climate of the plateau and the hot, moist climate of the sea-plain, and, indeed, that was one of the causes which made Taurus such an important barrier between nations. But there is so much to say on this point, and so many questions hinge on it, that I must refrain. Already I have trespassed too far, and yet I have been able neither to carry out my intention of giving a fairly minute description of the road, stage by stage, such as might exhaust the subject and be permanently useful for reference, nor to give an account of the many topics that suggest themselves at every important point.

The pass ceased under the Turkish rule to have any importance as a trade route. Trebizond and Smyrna were the sea-ends of the only important trade-roads of Turkish Asia Minor. This was due to several causes, on which time does not permit us to enter. But there has been recently a great increase of traffic on the road. We were told of lines of camels stretching almost continuously from the Gates to Tarsus; and though what we actually saw fell very much short of the description, yet it was very much in excess of our experience in 1890 and 1891. Moreover, our journey took place in a very slack time, before the busy period of the year had begun.

APPENDICES.

I. Table of Heights and Distances.

	Kilom. from last point.	Ramsay, 1902.	Ramsay, 1891.	Sir C. Wilson.	Major Bennet.	Colonel Stewart.	Oberhummer.
Konia	—	[3370]	[3370]	—	—	—	—
Eregli	—	3670	3690	3400	—	—	—
Watershed 5 miles west of Ulu-Kishla	—	5440	—	—	5230	—	—
Watershed 2 miles north-west of Ulu-Kishla	—	—	4900	—	—	—	—
Ulu-Kishla	3	4850	4830	4570	—	—	—

I. Table of Heights and Distances—*continued.*

	Kilom. from last point.	Ramsay, 1902.	Ramsay, 1891.	Sir C. Wilson.	Major Bennet.	Colonel Stewart.	Oberhummer.
Junction of Roman road from Tyana to Gates	4	—	4630‡	—	—	—	—
Cheshmeli-Khan	7	—	4140	—	—	—	—
Porsukh-Deirmen	1½	—	4070	—	—	—	—
Tossun-Ali	2½	—	3800‡	3400	—	—	—
Bridge at Giaour-Sindikh	¾	—	—	—	—	—	—
Kochak bridge	3	3630	—	—	—	—	—
Chifte-Khan	3½	3240‡	3490*	3090	—	—	3543
Takhta-Keupreu	9	3010	2990‡	2800	—	—	—
Ak-Keupreu	5½	2860	2850	—	2980	—	—
Bozanti-Khan	7	—	2680	—	2820	2750	—
Hill	2	—	2960	—	—	—	—
Bottom	1	—	2740	—	—	—	—
Aiva-Bey	5	—	3240	—	—	—	—
Tekir Khan	4	4200	—	—	—	—	4527
Tekir summit	2	4300	4240	—	—	4300	4822
The Gates	5	3760	3730	3740	—	3800	4527
Giaour Harman	4½	—	—	—	3100	3000	—
Sarishek Khan	5	—	2690	2700	—	2700	—
Mazar Oluk	6¼	1990	1950	2000	2200	—	—
Tarsus	38	[70]	[70]	—	—	—	—
Adana	—	[100]	[100]	125	111	—	459
Mopsouestia	—	—	—	100	—	—	525
Eukyz-Oluk †	—	—	—	—	—	1670 †	4429
Nigde	—	—	—	3910	4100	4300	4626
Tyana (Eukyzly-Hissar) †	—	—	—	3600	—	—	4265

* This is clearly erroneous—over 200 feet too high; a thunderstorm on the mountains seems to have disordered the aneroid.

† Eukyz is an attempt to approximate to the common pronunciation of this word, which is a very common element in local names, and one which is constantly misunderstood by travellers. Eukyzly-Hissar, the modern name of Tyana, "fortress rich in cattle," is commonly misrepresented as Kilisse-Hissar, or Kiz-Hissar, or Kizli-Hissar (Kiz means "girl"). On the map here published, and in my writings on the subject, Eukyz-Oluk is spelt Ekuz-Oluk (neglecting the modification of the vowels). The height stands as 1670 in my notes of Colonel Stewart's route. I think that there is a slip on my part or on his, and that the number should be 2670. I have not been there.

Note.—My readings are estimated by aneroid by differences from Konia (railway measured height) and Tarsus. Numbers marked ‡ indicate a mean calculated between readings at two points in the neighbourhood. My readings were not taken at the same points on the two journeys. The estimates quoted from Sir C. Wilson (except a few which I take from his *Handbook*), Major Bennet, and Colonel Stewart have been in my note-book for a long time: I believe they are all aneroid readings, except that some of Sir C. Wilson's are calculated from boiling-point observations. Oberhummer's numbers are taken from his 'Durch Syrien und Kleinasien' (Berlin, 1898). A professional geographer, his numbers seem furthest away from the truth.

II. The Ancient Itineraries are probably to be restored as follows:—

Itin. Hierosolym.	Itin. Antonin.	Peutinger Table and Anonymous Ravennas.
Andabalis.	Andabalis.	Tyana.
Tyana, [xviiii].‡	Tyana, xvi[iii].	[Tyana, xviii.]
Faustinopolis, [x]xii[i].	Faustinopolis, xxiii.*	[Faustinopolis, v.]
Mut. Caena, xiii.		Aquæ Calidæ [xiii].
Mans. Podandus, xii[i].	Podandus, xxvi.†	Podandus, xii.
Mut. Pylæ Finis Capp. et Cil., xiiii.		Fines Ciliciæ, xv. (Table reads xxv.)
Mans. Mopsoukrene, xii[i].	Mopsoukrene, xxvii.	
[Mut. in Monte = Quadriga, xii].		[Mutatio] in Monte, xxv.
Tarsus, xii.	[Tarsus, xxiv.]	Tarsus, xii.
Mut. Pargais? xiii[i].		
Adana, xiiii.	[Adana, xxviii.]	Adana, xxviii.
Mopsouestia, xviii[i].	[Mopsouestia, xviiii.]	Mopsouestia, xix.
Mut. Tardequeia, xv.	Aigeai, xxi.	Anazarbus, xxvii.
Mans. Katabolo, xvi.	Katabolo, xxiiii.	Epiphania, xxx.
Mans. Baiae, xvii.	Baiae, xvi[i].	Issos, xx? (Table reads xxx.)

Note.—The ancient authorities evidently go back to one original authority, in the form of a map, from which our extant itineraries (and lists of cities like Anonymous Ravennas and some of Ptolemy's lists) were abridged: sometimes the itineraries follow alternative routes, as was natural when all were taken from a map. That original authority was doubtless the Roman official map. Measurements to a town off the road (*e.g.* Faustinopolis, *i.e.* Colonia Faustiniana, or Aquæ Calidæ) were not reckoned up to the town, but only to the nearest point on the road. Thus, Faustinopolis xxiii. is reckoned from Tyana to the point on the road where a branch leads to Faustinopolis, about a mile or less distant; and the milestones, which are still preserved, stood at this point.

III. The Arab Topography of the Pass (Derb-es-Salama).

Tarsus		
al-Ollaik	12 miles.	Eski Tersus? Muzar?
ar-Rahwa		Mazar-Oluk? Sarishek?
al-Djawzat	12 „	Gates or Giaour Kharman.
al-Djardakoub	7 „	Tekir-summit.
al-Badhandoun	7 „	Bozanti.
Camp of King of Romans ...	10 „	Ulu-Kishla? Porsukh?
Wâdi-t'-Tarfâ	12 „	
Minâ	20 „	
River of Hirakla	12 „	Herakleia-Kybistra-Eregli.
Lake of Walia and al-Maskanyn		Ak Göl.
Zabarla [ancient Sidamaria]		Ambararasi.
Sidryya [ancient Sideropalos]		Sidirvar.
Borghouth [ancient Pyrgos].		Cassaba

* xviii. in MSS.

† Parthey xvi., following some of the MSS.

‡ Words or numbers omitted in the manuscripts are put in square brackets.

IV. Note on the Maps.

There is, as is well known, no good map or trustworthy map of Asia Minor. There is no city on the plateau whose situation is certain within several miles. In attempting to adapt route-surveys between such places as Angora and Konia, or Sivri-Hissar and Ak-Sheher, to the map, this uncertainty becomes exasperating. The most practically useful maps to the traveller in the country are the district maps of travellers like Colonel von Diest or Admiral Sprat, who delineated what they saw in the order that they saw it. But such maps are not so useful when the traveller comes to plot his own routes and fit them into the general scheme. Then the uncertainty comes in to baffle his attempt. The late Prof. H. Kiepert more than once mentioned this uncertainty to the present writer. All general maps are equally affected by it. With the means now available, this uncertainty ought now to be put an end to; but people are so much taken up with more distant and more popular enterprises that the small sum needed to do this work, so useful and (one might almost say) indispensable in the questions that must be settled in the near future, is not likely to be available.

The maps accompanying this paper partake of this uncertainty. I sent in to the Society three sketch-maps, adapted and modified in details from a map which, in its turn, had been founded almost entirely on Major Bennet's surveys in Cilicia, 1880–1882. That fundamental map was found to have various defects; some of these could be corrected, others could not without making a new map, for which the materials are not as yet available. For example, the Turkish measured kilometres showed that the scale of Major Bennet's map was very slightly smaller in the mountains than in the part south of Mazar-Oluk; this was probably due to the fact that it was based on dead reckoning by the time of a horse, and that in a given time a horse gets over a little more ground in the level country than on the rough mountain paths. But, as a whole, his map of Cilicia was much the best that I have seen.

R. Kiepert's new map was taken as a basis, and my correction embodied on that as far as possible. But for reasons given above the result cannot be considered satisfactory. The map represents no one; it is modified from Kiepert, but it is still further from what I think right.

The measurements given in Appendix I. will not be found to correspond exactly to these or to any map. They are given according to the Turkish kilometre-stones, but a slight attempt has been made to lessen the error in the stones beside Chifte-Khan, as mentioned in the paper.

When starting for this journey, I vainly tried, both in London and in Paris, to purchase a trocheameter, and the officials of the Society also tried. No one had a trocheameter ready, though many were prepared to make one. I expected that my good friend, Mr. E. Purser, manager of the Ottoman Railway, would lend me one; but when I reached Smyrna, I found that he had retired from office. There can be no doubt that, by a careful combination of the trocheameter and the Turkish measured kilometres, this road from Tarsus to Nigde might be made the basis of a greatly improved map of the eastern regions of Asia Minor, but the instrument must be ordered some months beforehand by the intending explorer.

If I have been obliged to mention the errors in the maps of the late Prof. H. Kiepert and his son Dr. R. Kiepert, I trust it is understood that I do so only for the sake of drawing attention to the urgent need of improvement in knowledge,

and from no wish to depreciate or undervalue the immense services rendered under great difficulties to all students and travellers in Asia Minor by the late H. Kiepert, whose spirit and work were beyond all praise. That R. Kiepert should continue and perfect his work is the wish of every one. But if we keep up the pretence that the existing maps are good, we only deprive Kiepert of the chance of completing his work and fulfilling his honourable ambition.

Before the reading of the paper, the PRESIDENT said: We have to welcome this evening again Prof. Ramsay, from whom we had a very interesting paper on Asia Minor a short time ago. He is now going to give us an account of his labour, in Cilicia and Taurus. I call upon Prof. Ramsay to read his paper.

After the reading of the paper, the following discussion took place:—

Sir CHARLES WILSON: I think we are all much indebted to Prof. Ramsay for his most interesting paper. The paper, which will be published in the *Journal*, gives the road through the pass in great detail. I also think we must congratulate Mrs. Ramsay on the beautiful photographs which have shown upon the screen. The pass is certainly one which cannot be surpassed in picturesque beauty. There are one or two points upon which I should like to say a word. One is with regard to the course of the rivers in the plain. I think that at one time the ancient Mallos was very probably an island, and with regard to the connection between the Sarus and the Pyramus, I may mention that an old channel was followed by Colonel Bennet, who was at Adana in the early eighties. There can be no doubt that at one time the Sarus did flow into the Pyramus, and I think you will see from the map that it would be almost the only course for the river to take on its way to the sea in times long past. Then with regard to the Cilician gates, I had the greatest curiosity to see these celebrated gates when I was in Cilicia, and I travelled through them, and went on to the position taken up by Ibrahim Pasha. Coming back we took a road on the right bank of the river, and found a comparatively easy way which could be readily made passable for artillery to the west of the Gates. I remember thinking at the time that it was possibly the road followed by the army of Cyrus when he descended into the Cilician plain. Xenophon does not mention the Gates, and he certainly passed by some other road—possibly that which we followed. I do not remember any great battle at the Gate itself, but it is certainly an extraordinary feature, and the making of a cart-road through it must have been a very great work in the olden days, and one that facilitated commerce between the plateau of Asia Minor and the sea. I have always thought that the easiest pass across the Taurus was that by which the Turks took their artillery on their march to Northern Syria; it is some distance east of the Cilician Gates. But that route would not be a good one for the Baghdad railway to follow, because when you get out of the pass you find yourself in very difficult country for a railway; the hard limestone rocks present great difficulties, and I think the line the Germans appear to have adopted is the best under the circumstances. It is the easiest route, although it has its difficulties, and it is the route which will provide the greatest amount of traffic for the railway. When I was in Asia Minor I took great interest in the lines of railway, and it may perhaps interest you to hear the origin of the railway from Mersina to Adana. There was a progressive governor of Cilicia at that time, and I spoke to him about the desirability of having a railway to carry the produce of the great plain to the sea. He concurred, and asked Colonel Bennet, who was at that time vice-consul at Adana, to obtain the requisite information. An estimate and plan for a metre-

gauge railway were obtained for the governor, but when he sent it on to Constantinople, he was told that he must either have a broad-gauge railway or none at all. The consequence was the construction of the present broad-gauge line, which, I believe, has never quite paid its expenses, or only just paid them. Prof. Ramsay alluded to the great difference between eastern and western Cilicia in olden days, and it is a curious fact that the same distinction between the two plains exists at the present day. The great alluvial plain is well cultivated; and one reason for its high state of cultivation is, that there has been a large migration of the curious people, Ansarîyeh, alluded to in one of Disraeli's novels, who are extremely good cultivators and gardeners. They have come down in large numbers and have settled on the plain. Eastern Cilicia, on the other hand, is, or rather was some time ago, entirely the home of the nomads, who come down in great numbers from the high country to the north to pass the winter. It is a most interesting sight in winter to see the whole of this portion of the plain covered by the animals, the sheep, the camels, and oxen, that have come down from the higher country. Very little of that portion of the plain is cultivated, but it is quite as fertile or nearly so as the plain of western Cilicia. Prof. Ramsay also alluded to the English railway from Smyrna, which is now cut off from the interior by the German railway. It is curious that this question of Smyrna and Constantinople is much the same as that in Egypt between Alexandria and Suakin. In the olden days the Pasha of Egypt would never allow a railway to be made to Suakin, because he wished to bring all traffic down to Alexandria, and thus throw money into the hands of the Alexandrian merchants. It was one of General Gordon's pet schemes to make a railway to Suakin, but he was unable to get the Egyptian Government to consent. Now, the only railway, that to Khartum, was made for military purposes, but those military purposes having been served, the railway to Suakin is about to be commenced. The point is this, that commerce will always find its way to the nearest outlet by the shortest land-passage, and it is only a case of waiting a certain number of years for all the commerce to go to Smyrna instead of Constantinople. I believe the German company has several times tried to purchase the English railway, and if they ever get possession of it the trade will probably come down to Smyrna. I can only say what pleasure it has given to me to hear Prof. Ramsay's paper this evening. There is no one who is such an authority upon the subject.

Rev. H. S. Cronin: I am afraid I can only say what very great pleasure it has been to me to hear Prof. Ramsay, and at the same time to express my gratitude to him for allowing me to accompany him on one occasion. All that I can add is, the eastern part of Asia Minor being unfamiliar to me, that so strong was the wish to prevent trade coming down to Constantinople instead of Smyrna, that there is no proper junction at all. There is a separate station for the Smyrna railway, and another station for the Constantinople railway, and the railways which have been put down between the two have been pulled up. I wish I could add more to the discussion, but I was absolutely unprepared for the possibility of having to take part in it.

Rev. A. C. Headlam: I have some difficulty in addressing the meeting, because it is now nearly thirteen years since I was in that part of the country, and I never, unfortunately, had the privilege of passing through the Cilician Gates. I never went further than Bozanti, but I will try and mention one or two things, to the north of the Gate, of interest. You will see at the corner of the map reference to a place called Eregli. That recalls certain reminiscences. Eregli is a very interesting place on one of the roads between the head of the pass and Konia. It is an extremely fertile valley—in fact, one of the most fertile portions of Asia

Minor. It owes its fertility to the river, which was always impressed upon the popular mind as being the gift of the gods. It is a river which bursts fully grown from this side of the hill, which flows for about 30 miles through the valley and then disappears into the ground. After many arduous days of travel through the mountains, we arrived at Eregli, which seemed a land of plenty. Prof. Ramsey stayed behind in the town, and sent Mr. Hogarth and myself to the source of the river, in order to make an investigation of a very interesting Hittite monument which is there. I believe I must not say Hittite any longer. At any rate, at the source of the river there is an exceedingly interesting monument representing the king of the country offering a bunch of grapes and a sheaf of corn to the gods, and accompanied by those symbols which may or may not be deciphered. Prof. Ramsay stayed behind in Eregli, and we hoped he would replenish our larder, and we had agreed to meet him at some tents about 4 or 5 miles out of the city. We arrived there after a very hard day's work, late in the afternoon, and expected to find our tents pitched and a comfortable meal being cooked. Prof. Ramsay arrived at the same time as ourselves, and we discovered that his devotion to archæology was so great that he had spent the whole of the afternoon in deciphering Latin inscriptions, and had completely forgotten to order any food. The other place I should like to refer to is Bulghar Maden, which we visited in company with Mr. Hogarth, and again for the sake of copying a very interesting inscription. Bulghar Maden is a small town high up in the mountains, and is the site of some silver-mines which are still being worked, and which may be very productive for all we know. The whole of that country was famous from the very earliest times for its silver, and its mines have been worked ever since. A third district to which I should like to refer is the road starting from Bozanti and going north. We went through that road, and it struck me at the time as being an extremely attractive upland valley, the route running between lofty mountains with a rich well-watered country and with many streams in it. It has always seemed to me, ever since I travelled there, that Asia Minor is a place of extreme interest. It is of great interest from an archæological point of view, and also politically. Asia Minor has suffered for many generations under very bad government, but I believe that under the native Anatolian, with his physical strength and his power of endurance, it has the capacity of being the backbone of a very great power. He is certainly the backbone at the present time of the Turkish army, and under good government he might develop that country so as to make it exceedingly prosperous and very rich. In old days there was a city wherever a village is now, and with a little irrigation almost the whole of the country might be as fertile as some of the districts where nature has been more prodigal. I have been very much interested in Prof. Ramsay's paper.

The PRESIDENT: Those present at this meeting must, I feel sure, have felt great interest in listening to the description of such a country as Cilicia from so high an authority as Prof. Ramsay. It is extraordinary what historical interest attaches to this corner of Asia Minor. In describing it Prof. Ramsay has had to allude to many great historical events—to the march of Alexander before the battle of Issus, to the march of Septimus Severus against Pescennius Niger, to the alterations made in the course of the rivers by the Emperor Justinian, to the extraordinary change made by the knowledge and industry of the Romans and Greeks in converting a hideous swamp into a famous harbour. All these points show how interesting and important a knowledge of the physical geography of a country at various times is in the study of history, and I think, perhaps, the most interesting part of Prof. Ramsay's paper is the description of those famous

historical Cilician Gates. The interest was much enhanced by the beautiful way in which his paper was illustrated by the photographs. I am sure you will all wish to pass a unanimous vote of thanks to Prof. Ramsay for his most interesting paper.

A SCHEME OF GEOGRAPHY.

By Prof. W. M. DAVIS.

THERE is a certain profit in looking forward to the time when the Earth and its inhabitants shall have been so well studied that if all then known about them were put in print, the volumes thus formed would include the whole content of geography. The material there gathered might be arranged following either one of two plans. According to one plan, everything about a certain country would be brought together; this would make a treatise on regional geography. According to the other plan, all things of the same kind would be brought together; this would constitute a treatise on systematic geography. Under either plan, convenience would be served by adopting some reasonable scheme that might be invented for the arrangement of the parts into which the subject might be divided. Under regional geography, for example, the arrangement might be according to the continents and their political subdivisions. Under systematic geography, the arrangement might follow the usual order of globe, atmosphere, oceans, lands, inhabitants. Under each plan, use would be made of the other as a secondary guide. All the items under Mexico in a regional treatise should follow a systematic order of presentation; while all examples of a certain kind of lakes in a systematic treatise should follow a regional order of presentation.

A complete geographical treatise, regional or systematic, would be inconveniently bulky. Abbreviated editions would be in demand, and they might be abbreviated in several ways. In one way, unimportant or inconspicuous items would be omitted, and important or conspicuous items retained, wherever or whatever they might be. In another way, remote items might be omitted and home items retained. In a third way, difficult items would be omitted and elementary items retained. Thus handbooks and school books would be developed.

There can be little doubt that the abbreviated or simplified editions would gain in value with the approach to completeness of the treatises on which they were based, as well as with the competence of their authors. A hundred years ago the best geographies were necessarily silent concerning the then extensive unexplored parts of the world. To-day the best geographies contain a much larger body of information than their predecessors, but they are still silent concerning many of the more advanced problems of geography. A hundred years hence

there may be still much to learn, but great progress will by that time have been made in the more philosophical phases of geography, to which attention is not yet sufficiently directed. It is especially with the object of calling attention to some of these phases that this note is written.

The direction in which geographical progress is to be made in the next hundred years may perhaps be forecast from the direction of progress in the last hundred. Geography used to be a "study of the Earth and its inhabitants." Items were brought together in great number; they were described more or less empirically; but there was no sufficient effort made to explain and to correlate them. Correlation was greatly promoted by Ritter and his followers. Geography then became, not simply a study of independent items, but a study of the Earth and its inhabitants in their mutual relations. With the advance of science in general, the description of geographical items became more and more explanatory; but progress in the larger problems of correlation was retarded for half a century by the prevalence of a teleological philosophy, and until this was replaced by the doctrine of evolution, the modern phase of geography could not be reached.

In its present modern phase, geography is essentially concerned with the rational correlation of the items that fall under its two parts: on the one hand, the items of inorganic conditions that constitute the physical environment of living forms; and on the other hand, the items of organic response made by living forms to their environment. The first of these two parts is commonly called physical geography. In the United States this term is coming to be condensed into physiography.* The second part has no name; it includes certain phases of political and commercial geography, and it goes much further than either, because it is concerned with all forms of life instead of only with man and what is useful to him. It will here be called ontography; the main root of the word corresponding to that of palæontology, and the termination agreeing with that of physiography and of geography.

Thus understood, geography is concerned with the combination of physiography and ontography—that is, with the correlation between inorganic environment and organic response. Individual items, such as the course of an ocean current, the path of a valley, the area of a forest, the population of a village, fall under the physiographic or the ontographic division of the subject, and must there be studied as carefully and rationally as possible; but they will fail to attain a truly

* Thus employed, physiography is not directly concerned with astronomy and geology, or with physics and chemistry, as it has come to be, unfortunately, in my opinion, in England.

geographic quality as long as they are treated independently, instead of being brought into proper correlation with their fellows. The physiographic items, regarded as elements of controlling environment, must be associated in thorough-going geographical work with the ontographic responses that they have evoked. The ontographic items, regarded as responses to environing conditions, must be associated with the physiographic controls by which they have been governed. The course of a current will affect the distribution of living forms or the lines of navigation; the path of a valley will determine the location of roads and villages; the area of a forest is the response to land form,

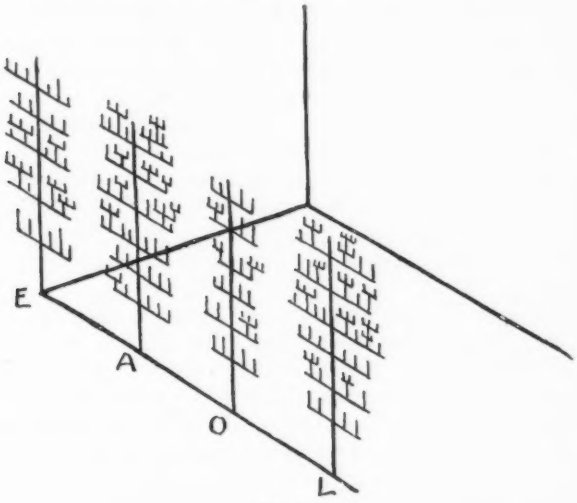


FIG. 1.

climate, and soil; the population of a village depends on many environing factors. No full measure of geographical treatment will be reached by the student who restricts his work either to the inorganic or to the organic half of the subject. Those who wish to train themselves to be fully equipped geographers should gain not only the capacity, but also the habit of giving due attention to ontography and physiography combined. The best geographical works to-day clearly enough exhibit the beginning of this double consideration of their subject, but they usually fall short of carrying the treatment thoroughly and uniformly over all aspects of the subject, and they commonly fail to show that their plan of treatment has been adopted in accordance with a sufficiently comprehensive view of geography as a whole. It is still usual in the best modern books to find many facts described as if they were lonesome individual occurrences instead of members of a recognized class, and

to find their description closed before they have been systematically correlated with their responses or their controls.

The quality of geography as a whole may be presented and emphasized by a simple graphic device that experience has shown to have some value. Imagine the four frameworks, E, A, O, L, Fig. 1, to stand in a vertical plane over the line EL, and to contain compartments for all the topics of systematic physiography under the larger headings of the Earth as a globe, the atmosphere, the oceans, and the lands. The compartments may be taken to represent types, with respect to which actual examples are classified. It may be briefly pointed out, although it is not intended to delay here in explaining all the practical value of this part of the device, that the observer is greatly aided in his work if he carries mentally into his field of study a well-arranged framework on which the types that embody the results of all previous investigations are carefully defined and arranged; for there can be no question that the habitual treatment of every observed physiographic item as far as possible as a member of a known class, is a most practical and serviceable aid in field observation and record. The framework must not, however, be imagined to represent a rigid and unchangeable scheme; it should be elastic and adjustable, constantly modified in response to accepted suggestions for improvement as investigation progresses.

Physiography is to-day relatively well developed; and the classification of its parts representable in a framework is fairly well advanced, although, for that matter, there is yet by no means so general an agreement among physiographers with respect to the systematic subdivision and arrangement of the items with which they have to deal as there is among botanists and zoologists with respect to the systematic classification of plants and animals. Some physiographers, for example, treat rivers and oceans in one division apart from the lands; others treat oceans and coasts together, before the lands have been studied; but both these plans are fortunately unusual. Ontography, on the other hand, has hardly any recognized scheme of treatment; it has still to be systematically studied. The framework on the further side of Fig. 2, by which a classification of organic responses is here roughly indicated, must therefore be taken for the present as suggesting what may yet be done rather than as representing what has already been done in this direction.

Even the limits of ontography are not yet agreed upon, and in considering with historians, zoologists, and botanists how far this division of geography may be reasonably extended, it is sometimes the case that one encounters certain indications of jealousy and accusations of trespass. Here, however, as in other sciences, it is not so much the object studied as the relation in which it is studied that determines its place in a scientific classification. The same object may be studied in

its varied relations under several different sciences. Surely history, zoology, and botany make use of geographical items so often that there can be little ground of just complaint if geography finds occasion to examine facts that are commonly associated with these other divisions of knowledge. The most reasonable method of determining the limits of ontography seems to be the following: Select certain examples of undoubtedly ontographic facts, and then, under the principle of continuity, follow the lead of the classes to which these facts belong as far as they can be traced; otherwise the limits must be arbitrary or conventional. There will be thus found certain facts that are indisputably and centrally ontographic, while others are peripheral, and are

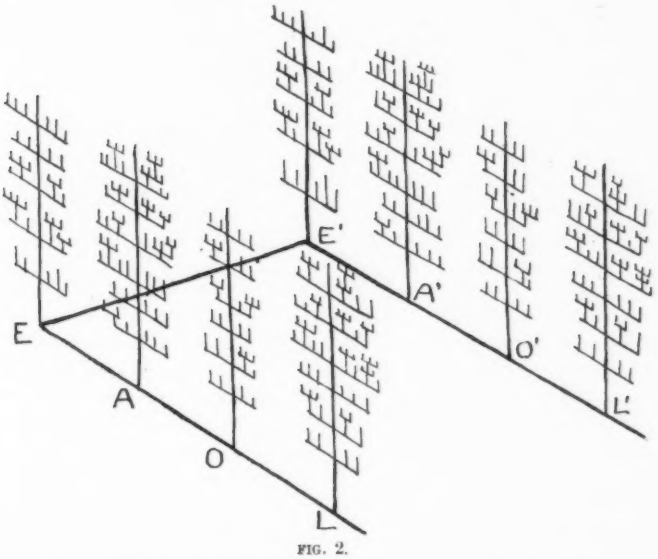


FIG. 2.

more or less shared with other sciences; but in the latter case, all the sciences concerned are equally trespassers. These abstract considerations may be illustrated to advantage by some concrete examples.

The location of a village at the head of a bay on the sea-coast must be considered by every one to be a geographical item, and according to the plan here presented it will fall under the ontographic half of the subject. In old-fashioned geography, such an item would have been empirically stated, without explanation of its meaning; in more modern geography, it would be rationally described as an example of a class of responses in which man's way of doing things is determined by his physiographic surroundings. Need having arisen of interchange between land and sea (this itself being an important ontographic matter),

the coast-line gains importance because it separates two kinds of activities; and protected points on the shore-line, such as bay heads, become of exceptional importance, because here the interchange between the two kinds of activities can be effected with the least difficulty. Now, the essential quality of this item is that certain organic inhabitants of the Earth have found it to their advantage to be guided in certain actions by the conditions of their inorganic environment. Hence, under the principle of continuity, every other item in which an organism is thus guided to act in certain ways is also of an essentially ontographic quality. It matters not whether the organism is man, animal, or plant, whether the action is conscious or unconscious, whether it is of great or little importance; the essential feature is that the item must involve a response or reaction of organism to environment. It is only by adopting an arbitrary limit for ontography, and hence also for geography, that anything narrower than this broad definition can be regarded as indicating its field.

The whole content of ontography, thus broadly defined, is not known, because its field has not yet been carefully examined; but enough is already known to show that the subject is of great and varied interest. It may be reviewed in two ways: all kinds of items found in the physiographic framework may be examined as to their responses in the organic world; or all kinds of organisms may be examined to see how far their structures, actions, and distribution are responses to physiographic controls. For example, in response to the important physiographic control of gravity, one finds the development of dorsal and ventral structures in many animals; those which escape this control are the minute organisms that are wafted about in the atmosphere, and the jelly-like organisms that float indifferently in one attitude or another in water. Again, one finds many details of bony structure and muscular arrangement adapted to support the body against the pull of its weight. The habit of building walls vertical and of grading railroads nearly horizontal come under the same control. Even language is affected indirectly, as in such adjectives as grave and upright, in their figurative meanings. On the other hand, one finds in the growth of trees the responses to many controls—to gravity and the search for ground water in the growth of the roots, to gravity and the search for light and air in the growth of the stem, to form of land surface and depth and character of soil as well as to various elements of climate in the determination of distribution.

It is evident that in most cases the responses above mentioned are not the result of the immediate adjustment of organism to environment, but of a gradual adjustment through long periods of past time, perpetuated through inheritance, provided the controlling conditions and need of adjustment still persist. The use of oxygen in respiration, universal in all plants and animals, is a case in point. This habit must

be taken as indicating the presence of free oxygen in the ocean (dissolved) or in the atmosphere since the earliest geological periods from which fossils are preserved; the habit persists because the need and the opportunity still endure. The fur of many land mammals is a response to climatic controls; but in the marine mammals that are in all probability descended from fur-bearing ancestors, the fur is replaced by blubber. Examples of more immediate adjustment are chiefly found in actions, as when horses and cattle on the western semi-arid plains of

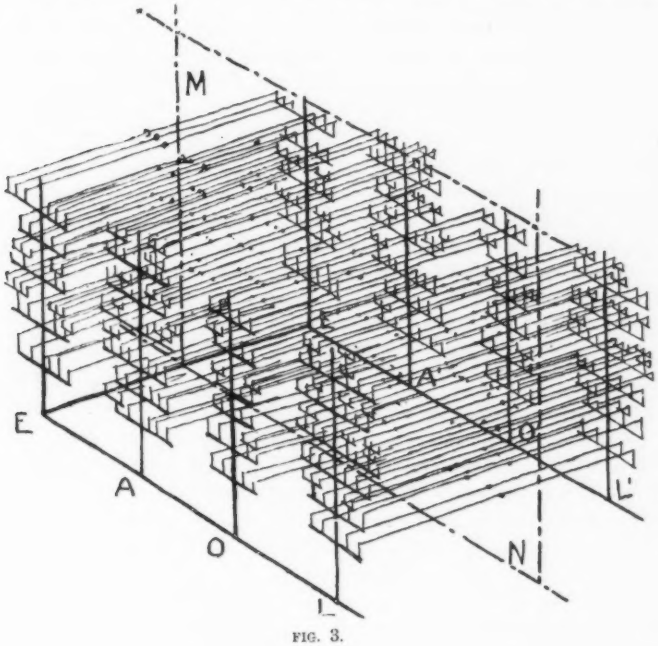


FIG. 3.

the United States wear paths from pasturing uplands to watering-places in the valleys, and yet here, as before, habit formed through long inheritance is the mainspring of action.

The classification employed in the ontographic framework may, in view of what has now been said, be imagined to follow either one of two plans. In one plan, all the responses to one kind of control are gathered in a single compartment, and there would be as many ontographic as physiographic compartments; this plan is followed in Fig. 2. In the other plan, each compartment would correspond to a kind of organism, and there would be as many compartments as might be needed to contain the subdivisions of the vegetable and animal kingdoms. Whichever plan is adopted, there can be little doubt that when

ontography is as well developed as physiography, geography will be greatly advanced. That stage of the development of our subject may be represented in Fig. 3, in which the correlation of physiographic and ontographic items is indicated by lines that stretch across from one framework to the other, the first of the above-mentioned two plans for ontographic classification being here again illustrated. The conscious recognition and discussion of the correlations thus indicated graphically by the cross-lines is indispensable for the full development of modern geography.

It should be noted in passing, but for the present only in the briefest manner, that there are innumerable correlations to be found also among the items of each framework, considered alone. For example, London markets are to-day supplied with meat products from Argentina and Australia, where herds of cattle and flocks of sheep find cheap pasture on broad plains fit for few other uses than grazing: these are correlations among items on the ontographic framework. On the other hand, the cliffs of Cornwall result from the interaction of waves driven by winds excited by sunshine and of currents involved in tides excited by lunar attraction, on the rocky structures exposed along the present coast-line by crustal movements. Again, in a maturely dissected region, such as the Piedmont belt of North Carolina, one may recognize the wonderfully delicate interdependence of hillside slopes, soil creep, stream wash, and river work that is involved in the thoroughly organized condition of the drainage systems there established. Both these examples exhibit correlations of items on the physiographic framework. None of these correlations are, however, shown in the diagrams, for fear of too great a confusion of lines. With this digression, we may return to the consideration of Fig. 3.

Imagine now a vertical plane, MN, parallel to the planes of the two frameworks and midway between them. This new plane will be intersected by all the cross-lines of correlation, and the summary of all the points of intersection may be taken to exhibit the whole content of systematic geography. The plane may be shifted towards one or the other framework, if it is desired to give greater emphasis to one or to the other part of geography, but the well-balanced geographer will doubtless prefer to hold the plane in a midway position, as here indicated. In case the biological classification of ontographic items were adopted, the lines of correlation would not be parallel; a group of lines would radiate from each kind of physiographic control in the nearer framework to all of its ontographic responses, and various lines from numerous kinds of controls would be focussed on the kind of organism in the further framework that responded to them.

It was stated above that this graphic device has been found by experience to have some value in indicating the compound nature of geography, as it is here defined, and in illustrating the relation of its

parts. It has a further value, namely, an aid in the practical analysis of a geographer's work. If, in the course of exploration or other study, an item of physiographic nature is found, the geographer must at once seek to place it in its proper relation to all other physiographic items, and to discover all the ontographic responses that it has excited. If an ontographic item is discovered, its physiographic controls must be sought for, and the correlations between the two must be studied out. This may seem so simple, so manifest, that it is hardly worth the saying; yet if any standard work on geography is examined and analyzed, it will be found far from complete in the sense of completeness here indicated. The work will undoubtedly give, more or less explicitly, many examples of correlation between controlling environment and responding organism, and it will thus confirm more or less clearly the compound nature of geography here exposed; but it will be only by way of rare exception that both phases of the subject are systematically presented, and that the correlations between them are consciously and completely analyzed. Exploration, in so far as matters of occurrence and location are concerned, has now been well advanced; exploration, in so far as thorough analysis of cause and effect is concerned, still affords plentiful opportunity for the investigator. There can be little question that studious observation and thorough record will be greatly aided when some such method of analysis as is here indicated shall have become familiar and habitual.

A few illustrations may be given to exhibit the breadth of geography, when it is expanded by the due consideration of its many parts. One is taken from an account of the oasis of Souf, in the Algerian Sahara, by Brunhes of Freibourg. This observer points out a relation between the sandy surface of the oasis and the character of the people as follows: every walking animal leaves its track in the sand, and from this follows an extraordinary skill on the part of the natives in tracking men and beasts; individual footprints can be recognized and followed through a confusion of crossing trails, where the untrained eye of a European would be unable to distinguish one track from another. As a result, theft is said to be less common in the sandy Souf than in the stony oases; the thief is so surely tracked and found that thieving is unprofitable.

Another example is furnished by Lugéon of Lausanne, who describes the relation between villages and alluvial fans in the higher valleys of the Alps. The fans offer the best sites for occupation; nearly every fan has its own village, each with its own organization, and the distribution of villages depends closely on the distribution of fans. As most of the fans are of small area, most of the villages must be of small size. An earlier writer has instanced the development of these small village communities as illustrating the innate spirit of independence in the Swiss people; but Lugéon points out that small communities

necessarily result from the small fans, and then aptly inquires whether the spirit of independence is not more probably a consequence than a cause of the subdivision of village communities.

Instances of this sort might be given in great number. Baku, the petroleum port on the arid shores of the Caspian, has rapidly grown to a population of something like 150,000 souls in consequence of the discovery and exploitation of rock oil near by. So large a population needs an abundant water-supply, not easily to be had in a region of so dry a climate as that of western Asia. Water could be brought at a considerable expense from a river over 50 miles away, but capitalists hesitate to undertake the construction of so long an aqueduct for a city whose population will mostly move away when the oil-wells give out; hence at present the local supply from wells of unsatisfactory quality is supplemented by distillation from the brackish Caspian, oil fuel being very cheap, and an ingenious system of boiling and condensation producing four pounds of distilled water for one pound of fuel. Nowhere else in the world is a distillery run on so large a scale and with so temperate an object! And who shall say that Baku's rapid growth and uncertain life, as well as its peculiar water-supply, are not ontographic items?

It is not intended to assert that all the examples of cause and consequence that might be given are established beyond dispute, but rather that they show the importance of making a thorough collection, a careful analysis, and a systematic classification of all such examples in order to carry forward the development of geography and to discover its entire content. Errors may evidently be made in speculations of this kind; for example, it does not seem safe to follow the statement of a famous geographer to the effect that the (supposed) taciturnity of the American Indian resulted from the darkness of the forest in which he lived. It is on the careful analysis of abundant observations, rather than on the refusal to speculate as to cause and consequence, that geography will thrive.

It is desirable that geography should be presented even to beginners as a subject involving the correlation of physiographic and ontographic items. When the globular form of the Earth is taught, that is the time to point out how largely the modern development of commerce results from the nearly level form that a globe alone possesses. When the size of the Earth is taught, that is the time for telling about the effects of its size in isolating savage races, and thus producing differences of language and customs, as well as for showing how greatly modern means of transportation and communication have overcome the earlier effects of isolation. With the form and rotation of the Earth there should be immediately associated the modern habit of laying out the boundaries of unsurveyed territories, as in North America, Australia, and Africa, along the meridians and parallels; and so on through the

whole subject. The young student may thus be thoroughly infected with the idea of correlation, and from such an introduction to geography he may more probably contribute afterwards to its advancement than if he had been taught in the old-fashioned empirical way, or in the more modern method of imperfectly developed correlation.

The most important steps towards the fuller development of geography therefore seem to be, first, the formation of the habit of looking for correlations of physiographic and ontographic items; and, second, the development of a well-considered classification of all items, physiographic and ontographic, so that all may be considered in reference to their fellows.

A JOURNEY ACROSS THE NYIKA PLATEAU.

By J. McCLOUNIE, Head of the Scientific Department, British Central Africa Protectorate.

THE following pages describe a journey from Karonga, *viâ* Fort Hill, to Nkata bay, undertaken with the object, firstly, of obtaining a precise knowledge of the north-western portion of Nyasaland and its agricultural prospects; and, secondly, of making botanical and zoological collections. The journey was to be made over little-known and sparsely inhabited country, and it was therefore thought advisable to halt only one day, or at most two, at any place, because of the question of food for native carriers, and the possibility of their deserting in any awkward situation. These reasons, therefore, did not allow of extensive collections being made. No information of the country to be traversed could be obtained beforehand, and only from native report could I learn that it was sparsely populated and mountainous.

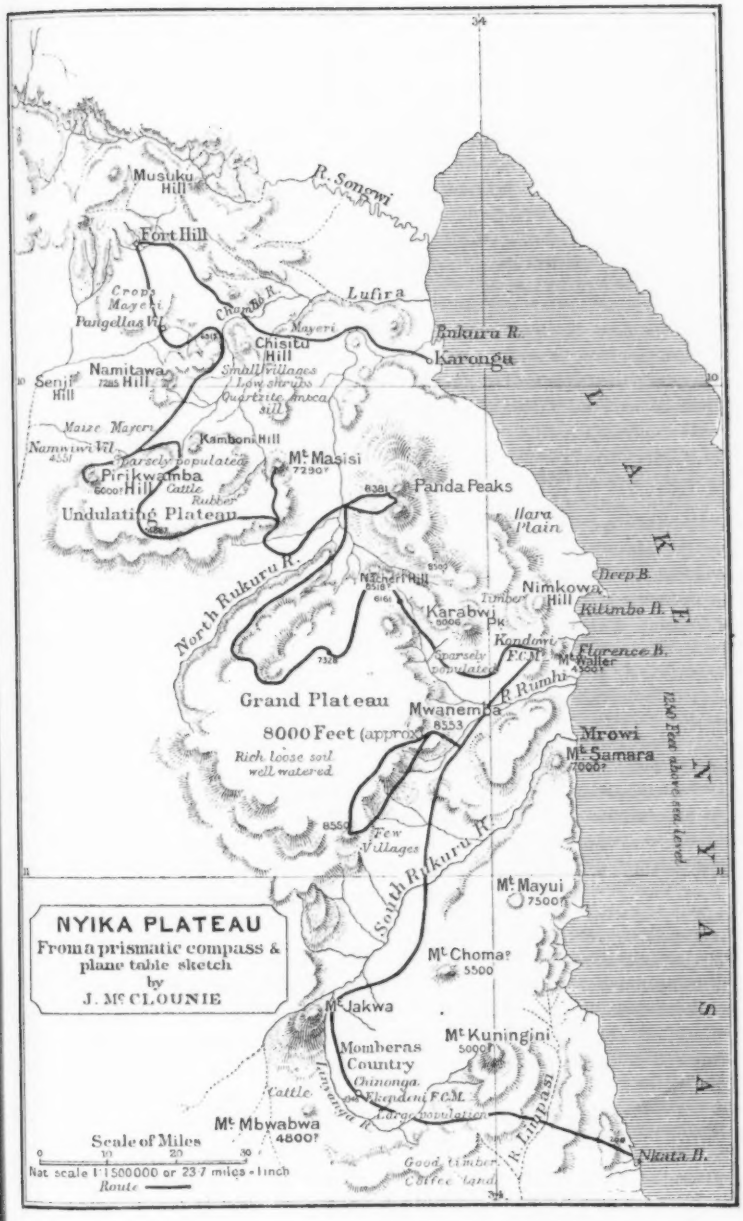
In order that the record of the journey might be more useful, I endeavoured to make a map of the country by prismatic compass and plane-table survey. Being without astronomical instruments, sextant, etc., I was unable to fix by latitude any of the important positions, hence the accompanying map is only approximately correct. The hazy nature of the atmosphere at this season of the year rendered distances "by estimation" very liable to be in error; this, however, I sought to correct as far as possible by marching, but this is also a source of error. The heights of the mountains and other places I ascertained by boiling-point thermometer (tables from 'Hints to Travellers'), and by the same instrument the height of Lake Nyasa I reckoned to be 1251 feet above sea-level. On existing maps it is given as 1590 feet, but by what method arrived at I cannot say. It is unfortunate that as yet the exact altitude of Chiromo (at the junction of the Ruo and Shire rivers) has not been fixed by spirit-levelling from Chinde. A recent railway survey

assumed that Chiromo was 500 feet above sea-level, and by spirit-levelling thence placed the height of the barometer at Zomba observatory as 3323 feet, which, on continuation, gave the height of Lake Nyasa as nearly 1600 feet. A late boundary commission passing through Chiromo fixed its height at 125 feet above sea-level, and by applying the reduction (−375 feet) to the B.M. near Zomba, the height of the barometer is given as 2948 feet; whereas by boiling-point thermometer it comes out as 2960 feet, a difference of 12 feet only, which strengthens my figures of 1251 feet as the correct altitude of Lake Nyasa, and also the heights determined throughout the journey, every precaution being taken to ensure correct readings.

Leaving Karonga on August 28, my intention was to proceed inland due west; but as the natives of this district are unsuitable as porters for long journeys, it was advisable that I should go to Fort Hill, where carriers are much stronger and able to travel on protracted journeys over hilly country.

Karonga was left at 10 a.m., and the Mpata Hill resting-place reached early in the afternoon. The river Rukuru, about ankle-deep and 30 feet wide, was crossed nearly halfway from Karonga, the Stevenson road again touching the left bank of this stream at a curve adjacent to the south-east slopes of Mpata. I ascended the small hill on the right of the road to see the nature of the country to the west, and to obtain rays to Masisi mountain; but the hazy atmosphere rendered this anything but satisfactory, making distant objects indistinct and near hills appear erroneously far off. It was from this cause impossible to fix a satisfactory base-line from which to commence plane-table work. Botanical specimens were unobtainable in this extremely dry and parched region owing to it having recently been burned, the only green vegetation visible being the banana groves of the natives, the fruit from which, together with milk, forms the chief means of subsistence. Notwithstanding the aridness of the country, cattle here were in splendid condition and numerous. The journey was continued towards Fort Hill, camp being pitched *en route* at the Lufira stream, which has a good flow of clear water. From this point the hitherto well-engineered Stevenson road becomes more difficult, and appears not to have been so well surveyed. I understand that, through the illness and death of the original surveyors, the completion of the road was deferred to a later date.

From the Lufira stream to the summit of Chambo hill the country is well wooded, has good grazing-ground, is undulating, with generally a rich dark soil. In the dry seasons the rainfall may be deficient, but the average precipitation probably ranges from 50 to 70 inches annually. The general elevation of the country is about 2800 feet above sea-level, with ridges running up to about 4000 feet, while its principal mountain,


Musuku Hill
R. Songwi
Fort Hill
Crops
Mayeti
Pangellas Vil.
Chomba R.
Lufira
Mayeri
Chisitu Hill
Small villages
Low shrubs
Quartzite knocal sill
Ankura R.
Karongu
Namitawa Hill
7285
Senji Hill
Maize Mayeri
Kamboni Hill
Namwiwi Vil.
4550
Pirikwamba Hill
6000?
Sparsely populated
Cattle
Rubber
Mt. Masisi
7290?
Panda Peaks
8381
Undulating Plateau
Ilara Plain
North Rukuru R.
Nimkowa Hill
Deep B.
Timber
Kilimbo B.
Karabwi Pk.
5006
Kondowi
Florence B.
Mt. Waller
4500?
Sparsely populated
R. Rumhi
Grand Plateau
8000 Feet (approx.)
Mwanemba
8353
Mrowi
Mt. Samara
7000?
Rich loose soil well watered
1240 Feet above sea level
Few villages
South Rukuru R.
Mt. Mayui
7500?
NYIKA PLATEAU
From a prismatic compass & plane table sketch
by
J. Mc CLOUNIE
Mt. Choma?
5500
Mt. Jakwa
Momberas Country
Mt. Kuningini
5000?
Chinonga
Ekwendeni
F.C.M.
Large population
Cattle
Leopards R.
Mt. Mbwabwa
4800?
Scale of Miles
0 10 20 30
Nat. scale 1:1500000 or 23·7 miles = 1 inch
Route
Good timber
Coffee land
R. Lufipasi
Nkata B.
LAKE NYASA

"Chisitu," may touch 5500 feet. The Chambo stream, which rises from the southern slopes of the Namitawa range, and flows along the northern slopes of Chisitu, was dry at the crossing, but, as will be seen later, had plenty of water a few miles higher up. Fort Hill was reached in two and a half days from Karonga. The station is situated on what is termed the "Nyasa-Tanganyika" plateau. The Musuku range of mountains is about 12 miles to the north of the station, and rises to some 7500 feet.

Obtaining sufficient porters from Mr. Farnill-Scott, the collector at Fort Hill, I left his hospitable roof and proceeded due south towards the Namitawa mountains, which appeared about 20 miles away. The general level of this plateau (judged from the boiling-point thermometer height of 3765 feet for the collector's house) is some 3700 feet, and in the neighbourhood of my route was very sparsely populated. A few huts of very primitive construction were passed, and after three and a half hours' travelling over thinly timbered land the village of Chief Pangella was reached, on the banks of the upper waters of the Loangwa. Surrounded by a stout stockade, his hundred odd people exist in huts built closely together, some of which were scarcely distinguishable from those of the cattle. The land here was cut deeply by the annual floods of the Loangwa, and revealed rich soil to a depth of 10 feet. The principal cereal grown by these people is named "ma'eri," or "maweri" (possibly *Panicum miliaceum*), and is largely used in the brewing of beer, as well as in the making of food in the form of porridge. In cultivation it is sown broadcast on circular pieces of land, sometimes one acre or two acres in extent, surrounded by a fence against the intrusion of game. Heavily timbered ground is selected on which to grow the crop; the branches of the trees are lopped off about 6 feet from the ground, and all laid thickly thereon to dry, and ultimately to be burned as the rainy season approaches. Many trees in the vicinity of these gardens are thus denuded of their branches for the cultivation of this crop. It is a method of ancient date, as evidenced by the trees all over the plateau having at one time received similar treatment.

Continuing the journey, Namitawa was reached in three hours. The influence of the 7000-feet peaks is apparent in the rank vegetation at the base. Large "mbemba" trees laden with a rather tasteless fruit similar to the Musuku are plentiful, and had there been more streams of the size of the Loangwa, this part of the country would have provided excellent land for the cultivation of coffee. As it is, there are many miles of suitable land, extending from the base of Namitawa to Chisitu and its neighbourhood. The massive rock formation of Namitawa resembles Mount Mlanje (in the Shire highlands) in its grey granite, cut by deep ravines, from which at this period of the year trickle streamlets, absorbed by the parched land before they run a mile

Royal Geographical Society.

NATURE AND OBJECTS.

THE ROYAL GEOGRAPHICAL SOCIETY was founded in 1830 for the Advancement of Geographical Science. It received a Royal Charter of Incorporation in 1859.

The Society's affairs are managed through a Council consisting of a President, Vice-Presidents, Treasurer, Trustees, Secretaries and twenty-one other Fellows, elected annually at a General Meeting of the Fellows.

The Society carries out the object for which it exists—

(1) By holding Meetings at regular intervals during the Session (November to June), at which communications are made and discussed by travellers, explorers and geographers, dealing with new discoveries, and with other matters pertaining to the field of geography.

(2) By the publication monthly of the *Geographical Journal*, in which are contained not only the communications made directly to the Society, but articles, notes and correspondence relating to geography and travel all over the world, and also a bibliography of all books, papers and articles dealing with geography published during the month, and lists of all the most important maps issued. The *Journal* is amply supplied with new maps and illustrations. It is sent free to all Fellows.

(3) By the issue of other occasional publications and maps.

(4) By the maintenance of a Library and a Collection of Maps and Photographs. The Library numbers over 50,000 volumes; there are 100,000 maps and 20,000 photographs. The Library and Map Room are open to all Fellows, and there is ample accommodation in the Society's House for reading and research. Each Fellow is entitled to borrow four volumes at a time.

(5) By the assistance rendered by the staff to those in search of geographical information.

(6) By carrying on a system of instruction for intending travellers in various branches connected with geography.

(7) By contributing to the expenses of exploring expeditions, and by lending instruments to travellers who are competent to use them.

(8) By encouraging, directly and indirectly, the improvement of geographical education.

(9) By the award annually of medals and other honours to distinguished travellers and geographers.

His Majesty the King is Patron of the Society, and H.R.H. the Prince of Wales Vice-Patron.

The President of the Society (1903–1904) is Sir Clements R. Markham, K.C.B., F.R.S.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter IV., § 1, of the Regulations, that,

"Every Ordinary Fellow shall, on his election, be required to pay £5 as his "admission fee, and £2 as his first annual subscription, or he may compound either "at his entrance by one payment of £35, or at any subsequent period on the following "basis:—

"Fellows of 20 years' standing and over	..	..	..	£12 10s.
" 15 " " and under 20	..	..	..	£16
" 10 " " " 15	..	..	..	£20

"And no Fellow shall be entitled to vote or to enjoy any other privilege of the "Society so long as he shall continue in arrear."

All Subscriptions are payable in advance, on the 1st of January in each year.

Copies of the Regulations and Candidates' Certificates may be had on application at the Society's House, 1 Savile Row, London, W.

The Society's House is open from 10.30 A.M. to 5 P.M.; on Saturdays to 1 P.M.; and on Meeting nights to 8.15 P.M.

On the Ground Floor of the House are the Offices and Map Room.

On the First Floor the main Library and the Council Room, which is available to Fellows as a reading room when not required for Council or Committee Meetings.

On the Second Floor are the Secretary's Office, the upper Library (fitted up specially for the use of Students), and the Librarian's Room.

On the Third Floor is another portion of the Library, a Smoking Room, a Room for Instruction, the Map Draughtsman's Department, and the Map Mounter's Work Room.

On the Roof is the Observatory.

Full details with regard to the Society, with List of Fellows, &c., are given in THE YEAR BOOK, copies of which may be obtained on application.

PROVISIONAL PROGRAMME.

Ordinary Meetings.

The following are the dates on which the Ordinary Meetings of the Society will be held, at 8.30 P.M., in the Theatre, Burlington Gardens (by permission of the First Commissioner of Works) :—

1903.	Wednesday,	November	4	1904.	Monday,	March	7, 21
	Tuesday	„	10		„	April	25
	Monday	„	23		„	May (*Anniversary*)	16
	„	December	14		„	„	30
1904.	„	January	11, 25		„	June	13, 27
	„	February	8, 22				

So far the following arrangements have been made :—

November 4.—Northern Nigeria. By Brigadier-General Sir FREDERICK D. LUGARD, K.C.M.G., C.B., D.S.O.

November 10.—North Polar Exploration, 1898–1902. By Commander R. E. PEARY, U.S.N.

November 23.—Recent Exploration and Economical Development in Central and Western China. By Lieut.-Colonel C. C. MANIFOLD.

December 14.—The Patagonian Andes. By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B.

Other provisional arrangements for meetings after Christmas are as follows :—

Exploration in Asia Minor. By Colonel P. H. M. MASSY.

Exploration on the Southern Abyssinian Border. By Captain PHILIP MAUD, R.E.

The Gulf Stream. By H. N. DICKSON, M.A.

The Regime of the Nile. By Sir WILLIAM E. GARSTIN, G.C.M.G.

The Lakes of New Zealand. By KEITH LUCAS.

Some Adventures in Antarctic Lands and Seas. By Lieutenant ERNEST H. SHACKLETON, R.N.R. (Christmas Lecture to Young People.)

N.B.—Information as to the Society's Meetings, and other matters of interest to Fellows, is given under the head of Notices, on p. iv of the monthly parts of the *Geographical Journal*.

Extra Meetings. When considered necessary by the President and Council, Extra Meetings will be held, and will be announced in the usual way in the *Journal*.

Afternoon Meetings. Special Afternoon Meetings will be held in the Map Room; of these due notice will be given.

Anniversary Dinner and Conversazione. The Anniversary Dinner of the Society will take place on the evening of May 16th, 1904. The date of the Annual Conversazione will be announced in due course.

Instructions for Intending Travellers. Details as to the Society's arrangements for instruction to intending travellers can be obtained by applying to the Secretary.

LEONARD DARWIN, } *Honorary*
JAMES F. HUGHES, } *Secretaries.*
J. SCOTT KELTIE, *Secretary.*

1 SAVILE ROW, LONDON, W.
October 1903.

towards the plain. Similarly with the Loangwa, in which, even at Pangella's village, there seemed to be less flow than there was at the foot of the mountain.

After pitching my camp beside one of these streams, I ascended a precipitous spur of the mountain to ascertain the nature of the summit, and make collections. Striking objects amongst the rocks were some examples of old and scraggy *Dissotis*, which carried a profusion of dark purple flowers, their bright yellow anthers resembling the long legs of the gaudy purple mason wasp, or "hornet" as it is commonly named. Stunted wind-blown specimens of *Vellozias* were plentiful, naked of leaves and flowers, and it is difficult to imagine how it is that, with the rains, such shrubs can produce such delicate white wax-like flowers, or, as in the small-growing species, the tufts of which are rarely over a foot high, can burst into a mass of pale purple flowers as soon as the atmosphere becomes humid. The common aloes were also plentiful. The summit was reached after 3½ hours' climbing, and was found to be of no great extent, and broken by deep rocky gorges.

It is regrettable that the majority of the photographs taken on the journey have not been a success. Every precaution was exercised in exposing, packing, and developing, but many of the plates turned out splotchy, streaky, and unsatisfactory; it is possible that they may have suffered from the heat, which one day would be extreme, while the next day, from a change of altitude, frost would be experienced.

The Loangwa flows north at this point, thence west and south-west. The altitude of the summit of Namitawa (by boiling-point thermometer) was 7285 feet. A higher point was seen a short distance off, but separated by a deep ravine; I estimated that it was nearly 150 feet higher. After taking rays to important hills on the line of march, I again descended the spur to camp, next day proceeding round about 5 miles to the Loangwa, where I stayed two days. Several rodents were secured here, also some botanical and zoological specimens.

The carriers, being near their homes, were dissatisfied, so it was advisable to get farther from Fort Hill as quickly as possible. A few huts were passed on the way to Chisutu, and the native supplied plenty of fresh cow's milk and other produce.

Much mica sparkles on the ground all round Namitawa, and there appears to be a fair proportion of quartz in the soil. The stream Chambo was seen when the east spur of Namitawa was rounded, and I followed up its course some distance to a village which would be due south of my camp at the Loangwa. Arriving at this village about 1.30 p.m., I decided to climb a prominent peak of Namitawa. This was an easy ascent, up a native path, and the height obtained was 6945 feet. In a damp corner of this hill at 6700 feet the flora resembles that of Mlanje at 5800 feet, with *Hypericums*, *Dissotis*, and aloes. The country hereabout had all been burned recently, and was not productive of many

good botanical specimens. The hunters, however, secured some interesting birds.

Starting next morning for two hills to the south and south-west, which appeared to be on the edge of a small plateau, we took a path leading through a maze of undergrowth of heaths and short shrubs. The soil was gravelly and hard, with at intervals swift-running streams from the slopes of Namitawa flowing to the Chambo or Lufira.

We marched past Kamboni hill, and due west the village of Namwiwi was reached, one of the most filthy villages I have ever seen. The population is perhaps 200 or 300 all told, and exceptionally dirty in its habits. A small stream runs north-west to the Loangwa, along which cattle get good grazing amongst the reeds. Many bird specimens of interest were obtained in the one day's stay here. The hill Pirikwamba was ascended to get rays to Masisi and other hills, Masisi appearing almost due east, while Panda peak could faintly be discerned.

Retracing my steps to Kamboni, the journey was continued on the plateau before referred to. The path led up by a climb of about 800 feet, then winding over an undulating plateau which had recently been burned over. The grass grows strong and long, and the plateau is dotted here and there with small clumps of trees, which, owing to these spots being dry, had not escaped the fire, interesting botanical specimens being consequently unobtainable. A better-watered part was reached after about five hours' march from Kamboni hill, a few villages being then met with, and cattle in good condition observed in considerable numbers. Evidently this place is not molested by wild animals, as cattle are not housed at night, but sleep in the open.

Halting at a village in a slight hollow, we obtained 4887 feet as the elevation, while the previous night at Namwiwi's village it was 4551 feet. A few hours' march took us over this plateau and across the upper waters of the Lufira, swiftly flowing to the north-east through a series of hills, amongst which I camped at noon, using the afternoon in exploring Mount Masisi, an isolated peak of about the same height as the smaller Namitawa. This on its south-east slopes is thickly wooded, all other parts being covered with grass about 2½ feet high and very thick. Rays were taken to Panda peaks, Nacheri, Mpata, and other hills. The haze was too dense for photography. Bushbuck are plentiful on the hills adjacent to Masisi, the larger game frequenting the lower slopes on the North Rukuru. In the better-watered parts of these hills, a number of old *Landolphia* rubber vines were seen, very much cut and barked, but now healed over considerably. The milk which exuded on cutting was of great consistency, and showed scarcely any water, producing a rubber very light in colour and of good quality.

Leaving the neighbourhood of Masisi, we struck towards a range of high mountains a little to the south-east, and after three hours' walking over ridges and down a long slope, the plain was again struck.

A number of villages were passed, and cattle in fair numbers were seen; but none of the villagers would accompany us as guides to the mountains, saying there was no water across the plain, and that there were no villages. The Karonga path was followed for a short distance, but as this appeared to lead too much away from the mountains, we struck across the plain through high grass, eventually following the dry bed of a wet-season torrent, in which there was no water for some miles, and then only in some deep fissures of the rocks was some green fluid found, which was, nevertheless, eagerly drunk by the parched natives. The country here was fairly well wooded, but extremely parched; not a green leaf on the trees, and no bird-life visible. It looked probable that the camp would have to be pitched for the night in a waterless district. Hope was given up, and I almost decided to retrace my steps to the village, then about 6 miles away. Everywhere the trees were burnt up, and no watercourses visible. Natives were sent out in all directions, and after some time the welcome sound "Madzi alipo" (Here is water) was heard away down the slope, and in a short time every one was making quickly for what turned out to be the North Rukuru river. It was low down in the hollow and out of view, hence its green trees could not be seen 200 yards away. The camp was pitched by its side for a rest on the Sunday, as we had been walking continuously the whole of the week.

At the crossing of the Rukuru near Karonga there was very little water, but at this point there was a large flow of water with numerous fish about the size of burn trout. Being in the vicinity of the peaks named Panda, I ascended one on Monday, and, if Masisi is a little higher, it was much easier to climb than Panda. After an ascent of about 1000 feet, a small plateau or crater-shaped basin was met with, its eastern edge being the Panda peaks, while the other edges were hills of lesser proportions. It appeared to be a veritable game preserve, where rhinoceros, buffalo, zebra, and wart-hog had full possession. Smaller antelopes were also plentiful, but rhinoceros appeared to be most numerous from their spoor. Buffalo were in considerable numbers close to the Rukuru. Zebra and roan antelope were seen in pairs or singly, and were met with near the summit of Panda.

The flora of Panda was similar to that of Namitawa and Mlanje at similar elevations; the altitude obtained was 6381 feet. Some beautiful aloes were in flower, also Hypericums and Sedum-like plants, devoid of leaves, but having spikes of beautiful white star-like blossoms. From this peak diagonal rays were obtained to many prominent peaks in the vicinity, some of them being indistinct through the haze, but recognizable. Almost due south there appeared, faintly, the highest point of an important range of mountains. These had been kept in view for some time, and as I could gain no information respecting them, I was the more anxious to learn their true nature. From the high peak I

was on, a route which appeared practicable was selected, viz. to follow up the Rukuru some miles, then to round the precipitous face of the range, and follow a long spur which seemed to lead continuously to the summit. The descent from Panda was scarcely less arduous than the ascent.

Leaving the Rukuru camp next morning, the route followed up the stream for some miles over remarkably dry and rough country, crossing one tributary of the Rukuru, which came from the mountains to the east between Panda and the larger range. This had a considerable flow of clear water, indicating drainage of a large extent of land higher up. Travelling was continued—with a halt of an hour only—till 3.30 p.m., when the spur of the mountain to be climbed was reached, and the camp pitched. Traces of recently cultivated gardens were seen at this place, but no people.

Ascending an adjacent small hill, Mount Masisi had a compass bearing of 251°; the boiling-point thermometer gave the height of the camp at a small stream as 4291 feet, and from this position to the summit appeared to be at least another 3000 feet. Next morning the ascent was begun at 5.30 a.m., and the summit reached at 8.30 a.m., the route taken justifying the selection, as no insurmountable obstacles were encountered. As is the case with most mountains, game-tracks lead up the spurs, and by following one of these the ascent was easily made. After a halt of a few minutes at the ridge, progress was made north-east over what appeared to be a large plateau. From the many game-tracks seen in all directions, and occasional glimpses of roan antelopes, game seemed to be plentiful, and at noon a herd of fourteen zebra was seen a short distance off, one or two foals being in the herd.

The camp was pitched by the side of a small stream at 2.30 p.m. The ground traversed was undulating, and rocks were not numerous, but long rolling ridges were the striking features. Most of these had been recently burned over, but where this was not the case, the ground was covered by short grass 6 to 9 inches long, which was a season's growth. As little eminences were crossed, these ridges were seen to extend indefinitely in all directions, constituting one grand plateau at what I judged about 7500 feet above sea-level; nothing but rolling downs as far as the eye could reach, with no apparent depression on any side to indicate the limits of this plateau. Leaving camp at 3 p.m., I proceeded south-west about 2 miles to explore the plateau in that direction. A slight depression was apparent away to the south-west, and as the trend of the numerous streamlets was in that direction, I concluded that the north Rukuru river had its source on this part of the plateau. Between the long sweeping ridges were hollows, often of a very spongy nature, and resembling the black bogs in Scotland, with occasionally the usual little deep pools. From these bogs oozes the water which forms streamlets, and ultimately the larger rivers. At

the time of my visit, rain had been generally deficient throughout the Protectorate, but on the Nyika plateau, at places nearly 8500 feet, beautiful clear water could be had in plenty. Where it was sufficient to form streams, these were swift and of a brownish colour, nevertheless the water was of the purest description. Some roan antelopes were seen close to camp, and zebra appeared to be so common that any object seen on the sky-line might safely be assumed to be these animals, standing immovable and on the alert. There was little or no bush, and it was with difficulty that sufficient firewood could be obtained for cooking purposes from old scraggy heaths. Darkness followed sunset rapidly, and the air quickly became very crisp.

At this camp, owing to the cold, the carriers became very discontented, and it was hoped that next day the camp would be at a lower elevation and warmer. The temperature under the outer cover of the tent at 7 p.m. was—dry bulb, 51°; wet bulb, 46°. Boiling-point thermometer gave the height of the camp in the hollow as 7328 feet, and about 600 feet lower than the general level of the ridges. At 6 a.m. on September 18 (dry bulb, 46°; wet, 44°), a start was made to further explore the plateau, and if possible reach Deep bay. Heavy dew had fallen during the night, but at 7 a.m. a very cold biting east wind was blowing. After travelling about two hours along the upper ridges, and avoiding all unnecessary descents, the highest point came into view, and quick walking brought us to its base, near which was a small clump of trees of diminutive growth. The ascent of this eminence was made in one hour, and on this point lay the key of the situation.

A little to the north lay Panda, and north-west, Masisi. North and north-east, separated by a long deep ravine or valley, through which flowed a feeder of the Rukuru—crossed two days previously—extended a series of mountains, rocky and precipitous, and well over 8500 feet, joining on to the eastern ridges of the plateau some 10 miles away; whilst to the south-east a gradual depression was clearly defined, flanked by a prominent peak of Karabwi, estimated at 8000 feet, with a series of high ridges on the horizon. A long continuation of the plateau extended to the south, with no outstanding features. To proceed east meant a two days' journey with dissatisfied carriers who thought themselves lost, hence a better route had to be thought of. The depression to the south-east—lead where it might—at least promised a gradual descent to the lake, and a choice of this route was therefore made. The altitude of Nacheri was found to be 8518 feet. The hazy nature of the atmosphere rendered photography anything but satisfactory.

Proceeding along the course of the stream at a quick pace and descending, the camp was pitched at 4.30 p.m., just before which hour we passed a herd of twenty roan antelope. Klipspringer were plentiful

in some of the lower hollows. As the sun declined, the air, which was hot at no time during the days on the plateau, became much colder than on the previous evening. The altitude of the camp was 6161 feet.[1] At 6 p.m. the dry bulb was 48°, wet 44°; and at 8 p.m. the temperature had fallen to 42° dry bulb, and 48°·5 wet; dew falling heavily as the full moon rose over the crest of the mountains. A remarkable feature at the camps at these high elevations was the stillness of the night. Scarcely a sound could be heard, except the peculiar whistling of some night bird which sounded thus, "Tw-we—twir-r," otherwise no sound of insect life such as is common at lower elevations.

The night was very cold, and in the morning I felt certain that there had been frost. In a few minutes a boy brought in a handful of ice that he had found deposited on the boxes outside. At 6 a.m., September 19, the dry bulb stood at 33°, and wet at 32°·5, while all around lay hoar frost on the ground. The cold was felt very severely by the natives, who lost no time in setting about to shift the camp to some lower place. A long walk by the stream eventually brought us to the foot of Karabwi at 1 p.m., and, sending on the carriers to some villages, I ascended the peak. To about 7500 feet it is short grass, after which it is very precipitous rock, and rises to 8046 feet. From its summit the first welcome view of Lake Nyasa was seen, notably the long curve of the sandy beach of what is known as Young's bay. East of Karabwi the country is of a very broken description, cut by deep ravines, well wooded, but impassable without very severe climbing. West of Karabwi lies the valley of the Rumhi, the slopes of the plateau ending in a point to the south-west, well wooded to its crest.

When passing a small hamlet of three huts before reaching Karabwi, the villagers said that it was possible to reach Kondowi Mission station that day. It was, however, invisible from any point on Karabwi, so I did not expect to reach it. From the peak to the camp was about 3½ hours' walking through the dense vegetation to a village on the banks of the Rumhi, and here we were told that Deep bay could be reached next day. Although so rough and broken by deep ravines, a fair sprinkling of villages was seen dotted on the steep hill slopes, where maize and haricot beans were principally cultivated. A swamp crossed during the day's march exhibited much oxide of iron on the surface of its stagnant water. The height of the camp at Chimbuli's village on the Rumhi was 4780 feet.

Heavy rain was falling at 5.30 a.m. next morning, and the start was delayed a little, the rank vegetation on either side of the path being very wet. After about three hours' journey towards Kondowi, over a series of ridges and dales, Kondowi was finally reached. The station is some distance inland, south-west from Deep bay, and near to Mount Waller, a mountain I had been looking for for several days, and which, being only some 4800 feet high, could not be seen from high elevations.

From board ship on Lake Nyasa, Mount Waller appeared to be very high, but from the level of the lake the first ridges are deceptive, and appear higher than they really were. It being then Saturday, a halt of a day or two was made at Kondowi, where the interesting work of this mission was seen in full swing. Even at night the schools were crowded with studious natives, eagerly preparing for their approaching examinations. The wooded slopes of the Nimkowa heights were ascended on Monday, rays being taken to prominent hills south and south-west. Although very hazy, one could trace out the mountains forming the southern limits of the plateau at the base of which lay the great Ahenga valley, through which flows the southern Rukuru river from beyond Mombera's country.

Some interesting specimens were obtained on Nimkowa, which was 6640 feet in altitude. The forest at this elevation is composed of evergreen deciduous trees of great age and much value. That on Nimkowa extends for a considerable distance along the ridges of mountains back to Karabwi and also to the northward. Mr. Adamson of the Livingstonia Mission very kindly showed me through the woods and the sawpit, and also supplied me with specimens of the timber used by him. The principal cut is locally named "m'ndopi," a good class of wood, with fine grain, and often obtained in lengths of from 50 to 60 feet—fairly straight logs with a diameter of 18 to 20 inches, not tapering as much as do coniferæ. "Masuka," "muhihi," "malombe," and "chiere" are names of different woods used, the last mentioned being a particularly light wood showing a remarkable arrangement of cells both in transverse and longitudinal sections. From Nimkowa heights good views are obtained across Lake Nyasa to Amelia bay on the east; to the mountainous country bordering on Nkata bay on the south; along the Ahenga valley to Mount Jakwa and Mombera's country to the south-west; and to the spurs of the Nyika plateau on the west.

Staying over the night at Nimkowa, the temperature was 63° at 8.30 p.m., a good breeze blowing from Lake Nyasa. After packing up cases of botanical and zoological specimens, and sending them to the lake to be picked up by the gunboat, the journey was resumed next day; but, on calling the carriers together, about eighteen had decamped and were said to have gone back to their homes. With compressed and reduced loads, my hospitable friends at the Kondowi Mission were left next day, my object then being to proceed to Mwanemba point, and explore the Nyika plateau further, thence proceeding along the Ahenga valley and on to Nkata bay. I had still plenty of rice for the carriers, in case no food could be bought. The route from Kondowi rapidly descends through a series of ravines, in which flow the big tributaries of the Rumhi, bringing down the drainage of the mountainous country abutting on Nimkowa. It finally passes along another ravine, through which flows the Rumhi itself, this being the river previously mentioned

as taking its rise on the slopes of Nacheri. It forms here a river of considerable size, swift flowing, with clear, good water, being about 20 feet wide and 3 feet deep, and must discharge a considerable amount of water into the lake during the wet season.

The vegetation round Nimkowa and Mwanemba indicates a heavy rainfall, and there is much country drained by the Rumhi. On some maps it is shown as flowing into the Rukuru, but of this I am doubtful. I did not, however, especially look into this matter, but from a distance, such as Mwanemba point, the Rumhi appears to take a course to the lake, entering immediately south of Mount Waller, while the Rukuru, it is known, enters the lake between a small ridge of hills and the base of the foothills of Mount Samara.* This small ridge of hills appears to be the termination of the Ahenga valley, and, I have no doubt, forms a very precipitous eastern face similar to Mount Waller, but to the south-west it is only a continuation of the general level of the valley. The Rumhi gathers its waters from the Nyika plateau, east and south of Mwanemba, and flows along the north side of the small ridge of hills mentioned above; while the Rukuru receives no affluents till near Mount Jakwa, where it runs along the base of the foothills of the plateau, thence across the valley, and due north-east between the aforementioned ridge and the mountains to the south, prominent amongst which are Mayui, Mount Choma, and Mount Samara.

Whilst absent collecting next day, the carriers decamped, leaving me at 6000 feet to get my loads down as best I could. I sent boys after them to try and induce them to continue their journey to Nkata, but they could not be found. It is thought that they were afraid of again camping on the plateau at high elevations, and this can have been their only reason for leaving. This desertion was very disappointing, as I intended to further explore the Nyika plateau away to the west from Mwanemba, but all that I could do now was to go as far as I could one day and return to camp. The face of Mwanemba I found to be thickly covered with rank vegetation and valuable virgin forest. Traces of former troublous times were seen by native grain stores being found in the darkest places of the forest. Villages were observed up to nearly 5500 feet, where maize was grown on the steep slopes. The chief's name was Chedewa, and apparently one to be feared in olden days, because of his practice of placing poisoned spears obliquely in the paths. The forests on Mwanemba are similar to those on Nimkowa, composed of evergreen deciduous trees of great age. The only coniferous tree met with was a species of *Podocarpus*, which does not attain to large dimensions,

* Mr. Henderson, who gave an excellent description of this country in the *Scottish Geographical Magazine* for February, 1900 (p. 88), says that the Rumhi "pours its waters over cataracts, and falls into the lake close to the mouth of the Rukuru."—Ed. *G.J.*

nor has it any distinctive qualities that might recommend it for use. The specimens to be found on Mwanemba are, however, not numerous. Ascending the plateau, I found that its southern highest point was 8553 feet, whilst away south-west there appeared another high ridge about the same elevation. Travelling from 8 a.m. till 1 p.m., its summit was reached, but a gale of wind prevented the boiling-point thermometer being used satisfactorily. Rays were taken to Nimkowa, Panda, Nacheri, and some high hills 12 miles to the west. When crossing a ridge, a herd of six roan antelopes were met with, apparently having their mid-day rest by a streamlet. They did not move far away on our approach, and allowed me to fix up my tripod camera and get two good views of them, at about 150 yards, but unfortunately both of these plates were stained and blotched, and thus useless. The country traversed was of the same description as that at Nacheri, undulating with short grass—an ideal grazing district for cattle or sheep. Many locusts were in evidence at 8550 feet, and I am of opinion that the great stretch of this undulating land with its very loose soil is, and has been, the breeding-place of countless swarms of this pest. The soil is remarkably loose, and is burrowed enormously by moles. Zebra, roan antelope, klipspringer, and partridge are very plentiful on this part of the plateau, but much shooting would soon reduce their numbers, or drive them from this their safe breeding-ground. They do not appear to be molested by wild animals, as there is no cover for these. Were it necessary or desirable that zebra should be caught alive, there would be little difficulty in doing so on the Nyika plateau, as the animals are very tame, and could easily be driven into one of the numerous hollows, at the head of which had been previously placed a stout net or fence. To retain this natural breeding-ground for zebra and roan antelope, it would be advisable to make the Nyika plateau a preserve. For a good sanitorium this plateau offers all that is necessary. The atmosphere is pure and bracing, with, at times—viz. June, July, and August—some frost. The general level is such as to afford abundant exercise, with a minimum amount of fatigue in climbing hills. The water, met with everywhere in plenty, is delightfully cold and good. With a road from Livingstonia across the Rumpi and up the slopes of Mwanemba, the plateau could be reached in one day from Florence bay, the present journey taking about one day and a half.

Owing to the carriers leaving me on Mwanemba, my loads had to be reduced, only necessaries being taken, while plants, ferns, etc., had to be left behind. I succeeded in getting one or two people from a village, but not sufficient to fill the places of those who decamped. Each native had now to carry his own food, to last till we should reach Nkata bay, all calico having been divided out and now finished. Marching from Mwanemba, along the Ahenga valley, through several miles of rich ground, covered by masuka trees, and crossing several

streams, evidently tributaries of the Rumpi, we reached the southern Rukura river at 4 p.m. It is here a broad stream with a sandy bottom, about 40 feet wide, and a little more than ankle-deep. In the wet season it would appear to be a very large river, flooding a large extent of country along its course. Reedbuck and bushbuck were plentiful, while traces of buffalo were seen. The boiling-point thermometer gave the height of our crossing the Rukuru as 3444 feet.

Continuing the journey up the right bank of the river, Mount Jakwa was reached about noon, the southern Rukuru coming between Jakwa and the Mwanemba range of hills. By following up the dry bed of a tributary of the Rukuru named Linyanga, thickly populated country was entered, and cattle were seen in large numbers. It might be advisable at this point to state, for the benefit of future travellers, that fresh milk may generally be had throughout most of the country which I traversed. There would be no difficulty experienced, by those who might visit the plateau in search of health, in having cattle taken up from the villages below, thus securing a supply of fresh milk and butter.

Mombera's country was entered towards noon on the following day, the neighbourhood of Mount Jakwa having been left at daybreak. The Ekendeni station of the Livingstonia Mission was reached at 1 p.m. This march was particularly fatiguing. The path (well defined) along the Ahenga valley was very hot and trying to the carriers' feet, while shelter from the sun was impossible, no trees or green vegetation being visible for miles over this thickly populated district. Villages were numerous, and consisted of from one to five hundred huts, closely packed together. At this season the male population was almost entirely absent, all able-bodied men and boys being away at Blantyre, Zomba, or elsewhere, at work. From the timberless appearance of the district, it would appear that every year the necessities of cultivation extend outwards from the site of the present villages. Mr. Stewart, who has been for some years resident at Ekendeni, says that it is only within recent years that such a complete clearing of timber off the land has taken place. Rainfall was deficient throughout this part of the Protectorate last year, and has also been scanty this year. The mission station is adjacent to the stream Linyanga, which has generally plenty of water, but it was very low at the time of my visit, and a little lower down was altogether dry. The altitude of Mr. Stewart's house is 4346, being almost 900 feet above the crossing of the Rukuru.

After a halt of one day at Ekendeni, a start was made in a north-easterly direction towards Nkata bay. Leaving the bleak country around Ekendeni, the path led through much low scrub, heaths, etc., similar to those met with south of Namitawa, and through many new gardens, evidently being prepared for the growth of much "mayeri." Many acres of land were now cut over, the timber lying in great masses,

3 feet deep, and acres in extent. Crossing the upper water of the Linyanga, near Kuningini mountain, about 11 a.m., Kuningini slopes were descended by 2 p.m. There is a marked alteration in the landscape at the base of this mountain as compared with Mombera's country further west, the country being heavily timbered and well watered by numerous streamlets. With the exception of one or two months in very dry years, the rainfall of Nkata district is satisfactory, and owing to its position on the lake, and to the numerous well-wooded small hills, the climate of this district is considered to be the most equable in the Protectorate.

Bordering on the Kuningini and Mayumi mountains there is very suitable coffee land, while along the Limpasa valley sugar and tobacco might be successfully grown, and I have no doubt that wheat would succeed equally as well as on the Shire highlands. Angoni or Atongi labour is near at hand and abundant. The woods would also be most suitable and natural for successful rubber cultivation, while the landing at Nkata bay is well known as one of the safest on the lake.

Nkata bay was reached on October 4, after I had been exactly one month on the journey from Fort Hill.

NOTES TO ACCOMPANY MAP OF THE YAVARY.*

By C. SATCHELL.

THE Yavary as it is written by the Peruvians and Bolivians, or Javary as it is called by the Brazilians, forms a portion of the frontier between Brazil and Peru, while the Bolivian frontier joins the other two at the source. Above the confluence of the Galvez, the Yavary is known as the Yaquirana (Brazilian, Jaquirana). In the flood season, say from November to May, the Yavary is navigable for steamers drawing 8 feet as far as the Coruça, about 208 geographical miles from its mouth. At all times such steamers get as far as Itecauhy, 33 miles.

In 1901 we travelled in a steamer drawing 7 feet as far as Saudades, 258 miles from the junction of the Yavary and Solimoës; thence as far as R. Bathan (708 miles from the Solimoës) in a launch drawing 3 feet 3 inches; and from this point to Rumi Yacu (817 miles from the mouth) in canoes. The total length of the Yavary from its source to its mouth (or confluence with the Solimoës) is about 825 geographical miles. The source is about 1250 feet above sea-level; it is a small spring oozing from the ground on a steep slope. The river, throughout its course, runs through a forest, unbroken except by the small clearings made by the rubber-gatherers around their huts. These clearings rarely exceed

* Map. p. 484.

an acre in extent. Rubber-gathering is practically the sole industry, and is decaying.

There may be 3000 people inhabiting the banks of the Yavary, not including "savage" Indians. We never saw one of these savages, but on our downward journey we stopped at a place where, a few days before, the whole of the inhabitants, seventeen in number, had been murdered by Indians of the tribe known as Mayus. This occurred in lat. 6° 35′. No trustworthy reports as to the numbers of the "savages" can be obtained, but it appears that those on the right, or Brazilian, bank are known as Rhemus, while those on the left, or Peruvian, side are Mayus and Capanaguas. These Indians have been driven away from the banks of the river by the Peruvians and Brazilians who have gone there in search of rubber.

The survey was made by means of a traverse, the bearings being taken by a 12-inch compass and the distances estimated, the whole being checked by observations for latitude and longitude. For these observations, the instruments used were a 6-inch transit theodolite, six chronometers, and a 3½-inch telescope for occultations.

In August, 1901, at the source, the variation of the compass was 7° 10′ easterly. The average temperature of the water was 76° at the mouth, and 71° 10 miles from the source.

We were on the Yavary from April till October, 1901.

TERRESTRIAL MAGNETISM IN ITS RELATION TO GEOGRAPHY.*

By Captain ETTRICK W. CREAK, C.B., R.N., F.R.S.

Of the six distinguished naval officers who have previously presided over this Section, four were Arctic explorers; and therefore, possessing personal experience in Arctic regions, they naturally gave prominence to the deeply interesting subject of the past and future of Arctic discovery in their addresses, whilst not forgetting other matters relating to the geography of the sea. The remaining officers, from their immediate connection with all that relates to the physical condition of the ocean, in its widest sense, coupled with the great importance of giving the fruits of their knowledge to the world, took that subject as their principal theme.

Valuable as are contributions to our knowledge of the physics of the ocean to the world in general, and especially to the mariner and water-borne landsman, I propose to take a different course, and bring to your notice the subject of Terrestrial Magnetism in its relation to Geography. In doing so, I shall endeavour to show that much may be done by the traveller on land and the seaman at sea in helping to fathom the mysteries connected with the behaviour of the freely suspended magnetic needle, as it is carried about over that great magnet, the Earth, by observations in different regions, and even in limited areas.

I would, however, pause a moment to call attention to the presence of several distinguished meteorologists at this meeting, who will surely attract many

* Presidential Address to the Geographical Section of the British Association, Southport, 1903. Maps, p. 484.

to the consideration of matters connected with the important science of meteorology, which already occupies considerable attention from travellers. I feel sure, therefore, that geographers will be glad to accord a hearty welcome to the members of the International Meteorological Congress now assembled in this town, and especially to the foreign visitors who honour us by their presence.

Some one may ask, What has Terrestrial Magnetism to do with Geography? I reply, excellent lectures on that subject of growing importance have been given under the direct auspices of the Royal Geographical Society; one in 1878 by the late Captain Sir Frederick Evans, and another in 1897 by Sir Arthur Rücker. And I would here quote the opinion of Dr. Mill when defining geography, in my support: "Geography is the science which deals with the forms of the Earth's crust, and with the influence which these forms exercise on the distribution of other phenomena."

We know now that the normal distribution of the Earth's magnetism for any epoch is in many localities seriously affected accordingly as the nature of the country surveyed be mountainous, or generally a plain, in the form of islands (or mountains standing out of the sea), and from land under the sea. There is also reason to suspect that the magnetism of that portion of the Earth covered by the oceans differs in intensity from that of the dry land we inhabit. A connection between the disturbances of the Earth's crust in earthquakes and disturbances of the magnetic needle also seems to exist, although the evidence on this point is not conclusive.

Magnetic Surveys.

Previously to the year 1880 there were two periods of exceptional activity on the part of contributors to our knowledge of the Earth's magnetism, during which the scientific sailor in his ship on the trackless ocean combined with his brethren on land in making a magnetic survey of the globe.

The first period was that of 1843–49, during which not only were fixed observatories established at Toronto, St. Helena, Capetown, and Hobart for hourly observations of the movements of the magnetic needle, but, to use Sabine's words, 'that great national undertaking, the Magnetic Survey of the South Polar Regions of the Globe,' the forerunner of our present Antarctic Expedition, was accomplished by Ross and his companions almost entirely at sea.

This Antarctic survey was carried out during the years 1840–45, and the results given to the world as soon as possible by Sabine. The results afterwards formed a valuable contribution when constructing his maps of equal lines of Magnetic Declination, Inclination, and Intensity for the whole world, a great work for the completion of which Sabine employed every available observation made up to the year 1870, whether on land or at sea.

Readers of these contributions cannot fail to be struck with the great number of observations made by such travellers as Hansteen and Due, Erman and Wrangel, extending from Western Europe to far into Siberia.

The second period was that of 1870–80, during which not only was there much activity amongst observers on land, but that expedition so fruitful to science, the voyage of H.M.S. *Challenger*, took place. During the years 1872–76 we find the sailor in the *Challenger* doing most valuable work in carrying out a magnetic survey of certain portions of the great oceans, valuable not only for needful uses in making charts for the seaman, but also as a contribution to magnetic science.

Prior to this expedition very little was known from observation of the distribution of Terrestrial Magnetism in the central regions of the North and South Pacific oceans, and Sabine's charts are consequently defective there.

Combining the *Challenger* magnetical results with those of all available observations made by others of H.M. ships, and by colonial and foreign governments,

I was enabled to compile the charts of the magnetic elements for the epoch 1880, which were published in the report of the scientific results of H.M.S. *Challenger*. I will venture to say that these charts give a fairly accurate representation of the normal distribution of the Earth's magnetism between parallels of 70° N. and 40° S. Beyond these limits, either northward or southward, there is a degree of uncertainty about the value of the lines of equal value, especially in the Southern regions, an uncertainty which we have reason to hope will be dissipated when we know the full results obtained by Captain Scott and the gallant band he commands, for as yet we have to be content with some eddies of the full tide of his success.

Until the *Discovery* was built, the *Challenger* was the last vessel specially selected with a view to obtaining magnetic observations at sea, so that for several years past results obtained on land have been our mainstay. Thus, elaborate magnetic surveys with fruitful results have been carried out in recent years in the British Isles by Rücker and Thorpe. France, Germany, Holland, and some smaller districts in Europe have also been carefully surveyed, and British India partially so, by Messrs. Schlagintweit in 1857–58. The latter country is being again magnetically surveyed under the auspices of the Indian Government.

On the American continent the Coast and Geodetic Survey of the vast territories comprised in the United States, which has been so many years in progress, has been accompanied by an extended magnetic survey during the last fifty-two years, which is now under the able direction of Dr. L. A. Bauer. Resulting from this, some excellent charts of the magnetic declination in the United States have been published from time to time; and the last, for the epoch 1902, is based upon 8000 observations.

There are other contributions to terrestrial magnetism for positions on various coasts from the surveying service of the Royal Navy, and our ships of war are constantly assisting with their quota to the magnetic declination, or variation, as sailors prefer to call it; and wisely so, I trow, for have they not the declination of the sun and other heavenly bodies constantly in use in the computation of their ship's position?

This work of the Royal Navy and the Indian Marine is one of great importance, both in the interests of practical navigation and of science; for besides the equipment of instruments for absolute determinations of the declination, dip, and horizontal force supplied to certain of our surveying-ships, every seagoing vessel in the service carries a landing compass, specially tested, by means of which the declination can be observed with considerable accuracy on land.

Although observers of many other objects may still speak of their "heritage the sea" as a mine of wealth waiting for them to explore, unfortunately for magnetic observations, we can no longer say "the hollow oak our palace is," for wood has been everywhere replaced by iron or steel in our ships, to the destruction of accurate observations of dip and force on board of them. Experience, however, has shown that very useful results, as regards the declination, can be obtained every time a ship is "swung," either for that purpose alone, or in the ordinary course of ascertaining the errors of the compass due to the iron or steel of the ship.

As an example of this method, the cruise of the training squadron to Spitsbergen and Norway in 1895 may be cited, when several most useful observations were made at sea in regions but seldom visited. Again, only this year a squadron of our ships, cruising together near Madagascar, separated to a distance of a mile apart and "swung" to ascertain the declination.

I would here note that all the magnetic observations made by the officers of

H.M. ships during the years 1890–1900 have been published in a convenient form by the Hydrographic Department of the Admiralty.

The fact remains, however, that a great portion of the world, other than the coasts, continues unknown to the searching action of the magnetic needle, whilst the two-thirds of the globe covered by water is still worse off. Amongst other regions I would specify Africa, which, apart from the coasts, Cape Colony, and the Nile valley to lat. 5½ N., is absolutely a new field for the observer.

Moreover, the elaborate surveys I have mentioned show how much the results depend upon the nature of the locality. I am therefore convinced that travellers on land, provided with a proper equipment of instruments for conducting a land survey of the strange countries which they may visit, and mapping the same correctly, can, with a small addition to the weight they have to carry, make a valuable contribution to our knowledge of terrestrial magnetism, commencing with observations at their principal stations, and filling in the intermediate space with as many others as circumstances will permit.

The Antarctic Expedition.

Of the magnetic work of our Antarctic Expedition we know that since the *Discovery* entered the pack—and, as far as terrestrial magnetism is concerned, upon the most important part of that work—every opportunity has been seized for making observations.

Lyttelton, New Zealand (near which there is now a regular fixed magnetic observatory), was made the primary southern base-station of the expedition; the winter quarters of the *Discovery*, the secondary southern base-station. Before settling down in winter quarters, magnetic observations were made on board the ship during the cruise to and from the most easterly position attained off King Edward VII. Land in lat. 76° S., long. 152½° W., and she was successfully swung off Cape Crozier to ascertain the disturbing effects of the iron upon the compasses and dip and force instruments mounted in the ship's observatory.

As a ship fitted to meet the most stormy seas and to buffet with the ice, the *Discovery* has been a great success. Let me add another tribute to her value. From Spithead until she reached New Zealand, but small corrections were required for reducing the observations made on board. The experience of Ross's Antarctic expedition had, however, taught the lesson that two wood-built ships, the *Erebus* and *Terror*, with but some 3° to 4° of deviation of the compass at Simon's bay, South Africa, found as much as 56° of deviation at their position farthest south, an amount almost prohibitory of good results being obtained on board.

How fared the *Discovery*? I have been told by Lieut. Shackleton—for the cause of whose return to England we must all feel great sympathy—that a maximum of only 11° of deviation was observed at her most southerly position. From this we may look forward hopefully to magnetic results of a value hitherto unattained in those regions.

At winter quarters, besides the monthly absolute observations of the magnetic elements, the Eschenhagen variometers or self-registering instruments for continuously recording the changes in the declination, horizonal force, and vertical force were established, and in good working order at the time appointed for commencing the year's observations.

I may here remind you that some time previously to the departure of the British and German Antarctic expeditions, a scheme of co-operation had been established between them, according to which observations of exactly the same nature, with the same form of variometers, were to be carried out at their respective winter quarters during a whole year, commencing March 1, 1902. Besides the

continuous observations with the variometers, regular term-days and term-hours were agreed upon for obtaining special observations with them at the same moment of Greenwich mean time. Both expeditions have successfully completed this part of their intended work.

To co-operate in like manner with these far southern stations, the Argentine Government sent a special party of observers to Staten island, near Cape Horn, and the Germans another to Kerguelen Land, whilst New Zealand entered heartily into the work. In addition, similar observations were arranged to be made in certain British and colonial observatories, which include Kew, Falmouth, Bombay, Mauritius, and Melbourne; also in German and other foreign observatories.

We have all read thrilling accounts of the journeys of the several travelling parties which set out from the *Discovery*, and of the imminent dangers to life they encountered, and how they happily escaped them except one brave fellow named Vince, who disappeared over one of those mighty ice-cliffs, upon which all Antarctic voyagers descant, into the sea. In spite of all this, there is a record of magnetic observations taken on these journeys of which only an outline has yet been given. Anticipations of the value of these observations are somewhat clouded when we read in one report that hills "more inland were composed of granite rock, split and broken, as well as weatherworn, into extraordinary shapes. The lower or more outer hills consisted of quartz, etc., with basaltic dykes cutting through them." Consequently, we have to fear the effects of local magnetic disturbances of the needle in the land observations, whilst buoyed up with the hope of obtaining normal results on board the ship.

Judging from some land observations which have been received, it appears that considerable changes have taken place in the values of the magnetic elements in the regions we are considering, but when making comparisons we have to remember the sixty years which have elapsed since Ross's time, and that he had nothing like the advantage of steam for his ships, or of instruments of precision like our present ship *Discovery*. His ships also were, as we have already remarked, much worse magnetically, causing far more serious disturbance of the instruments. Hence the changes we note may not be entirely due to changes in the Earth's magnetism.

The observations made by the officers of the *Southern Cross* at Cape Adare in 1899–1900 also contribute to this question of magnetic change.

The Magnetic Poles of the Earth.

I will now refer to those two areas on the globe where the dipping needle stands vertically, known as the magnetic poles. The determination of the exact position of these areas is of great importance to magnetic science, and I will just glance at what is being done to solve the problem.

Let us consider the north pole first, the approximate position of which we know best from observation. If one were asked to say *exactly* where that pole has been in observation times, whether it has moved, or where it now is, the answer must be, "I do not know." It is true that Ross in 1831, by a single observation, considered he had fixed its position, and, I believe, hoisted the British flag over the spot, taking possession thereof; but he may or may not have set up his dip circle over a position affected by serious magnetic disturbance, and therefore we must still be doubtful of his complete success from a magnetic point of view. Although eminent mathematicians have calculated its position, and Neumayer, in 1885, gave a place to it on his charts of that year, we have still to wait for observation to settle the question, for one epoch at least.

Happily, I am able to repeat the good news that the Norwegian, Captain Roald

Amundsen, sailed in June last with the express object of making a magnetic survey of Ross's position and of the surrounding regions, in order to fix the position of the north magnetic pole. Furnished with suitable instruments of the latest pattern, he proposes to continue his investigations until 1905, when we may look for his return and the fulfilment of our hopes.

As far as we can now see, the south magnetic pole cannot be approached very nearly by the traveller, and we can only lay siege to it by observing at stations some distance off, but encircling it. We have our own expedition on one side of it, and now with the return of the *Gauss* to South Africa in June last, we have learnt that that vessel wintered in lat. 66° 2′ S., long. 89° 48′ E., a position on the opposite side of the supposed site of the magnetic pole to that of the *Discovery*. We may now pause to record our warm congratulations to Dr. von Drygalski and his companions on their safe return, accompanied by the welcome report that their expedition has proved successful.

In addition to the British and German expeditions, there are the Swedish expedition and the Scottish expedition. Therefore, with so many nationalities working in widely different localities surrounding it, we have every reason to expect that the position of the south magnetic pole will be determined.

The Secular Change.

When, in the year 1600, Gilbert announced to the world that the Earth is a great magnet, he believed it to be a stable magnet; and it was left to Gellibrand, some thirty-four years later, by his discovery of the annual change of the magnetic declination near London, to show that this could hardly be the case. Ever since then the remarkable and unceasing changes in the magnetism of the Earth have been the subject of constant observation by magneticians, and of investigation by some of the ablest philosophers in Europe and America. Year after year new data are amassed as to the changes going on in the distribution of the magnetism of the Earth, but as yet we have been favoured by hypotheses only as to the causes of the wondrous changes which the magnetic needle records.

These hypotheses were at one time chiefly based upon a consideration of the secular change in the declination, but it is now certain that we must take into account the whole of the phenomena connected with the movements of the needle, if we are to arrive at any satisfactory result. Besides, it will not suffice to take our data solely from existing fixed observatories, however relatively well placed and equipped, and valuable as they certainly are, for it now appears that the secular change is partly dependent upon locality, and that even at places not many miles apart differences in results unaccounted for by distance have been obtained.

The tendency of observation is increasingly to show that the secular change of the magnetic elements is not a world-wide progress of the magnetic needle moving regularly in certain directions, as if solely caused by the regular rotation during a long series of years of the magnetic poles round the geographical poles, for if you examine Map No. 1,* showing the results of observations during the years 1840–80 as regards secular change, you will observe that there are local causes at work in certain regions, whilst in others there is rest, which must largely modify the effect of any polar rotation.

Allow me to explain further. The plain lines on Map No. 1 indicate approximate regions of no secular change in the declination, and the small arrows the general direction (not the amount) in which the north-seeking end of the horizontal needle

* Originally prepared by the author for the "Magnetical results," H.M.S. *Challenger*, part vi. vol. ii.

was moving during those forty years. The foci of greatest change in the declination, with the approximate amount of annual change in the northern hemisphere, are shown in the German Ocean and N.W. Alaska, in the southern hemisphere off the coast of Brazil, and in the South Pacific between New Zealand and Cape Horn. The two foci of greatest annual change in the dip are shown, one in the Gulf of Guinea, where the north-seeking end of the needle was being repelled strongly upwards, the other on the west side of Tierra del Fuego, where the north-seeking end of the needle was being attracted strongly downwards.

It is remarkable that the lines of no change in the declination pass through the foci of greatest change in the dip. If the needle be repelled upwards, as at the Gulf of Guinea focus, it will be found to be moving to the eastward on the east side of the whole line of no change in the declination from the Cape of Good Hope to Labrador; to the westward on the west side. If the needle be attracted downwards, as at the Tierra del Fuego focus, it will be found moving to the westward on the east side of the whole line of no declination from that focus to near Vancouver Island; to the eastward on the west side.

A similar result may be seen in the line passing through a minor focus of the dip near Hong Kong.

Judging from analogy, there should be another focus of change in the dip in lat. 70° N., long. 115° E., or about the position assigned to the Siberian focus of greatest force.

On Map No. 2 are shown lines of equal value of the declination—the red lines for the year 1880, the black lines for the year 1895. From these, when shown on a large scale, we may deduce the mean annual change which has taken place in the declination during the fifteen years elapsed.

In this map we are reminded of the different results we obtain in different localities, for if a line be drawn from Wellington in New Zealand past Cape York in Australia to Hong Kong, little or no change will be found in the neighbouring region since 1840. Again, the line of no change in the declination shown on Map No. 1 to be following much the same direction as the great mountain ranges on the west side of the American continent, has hardly moved for many years according to the observations available.

On the other hand, let us now turn to an example of the remarkable changes which may take place in the declination unexpectedly and locally. The island of Zanzibar and the east coast of Africa were constantly being visited by our surveying-ships and ships of war up to the year 1880, observations of the declination being made every year at Zanzibar during the epoch 1870–80. The results showed that from Cape Town nearly to Cape Guardafui the annual change of that element hardly exceeded 1′.

During the succeeding years of 1890–91 observations were made by the Germans at Dar-es-Salaam and some other places on the neighbouring coasts, with the result that the declination was found to be changing at first 3′ annually, and since that period it had reached 10′ to 12′ at Dar-es-Salaam. Subsequent observations at the latter place in 1896–98 confirmed the fact of the great change, and, in addition, our surveying-ship on the station, especially ordered to "swing" at different places in deep water off the coast, generally confirmed the results. It is remarkable that whilst such great changes should have taken place between Capetown and Cape Guardafui, Aden and the region about the straits of Bab-el-Mandeb seem to be comparatively unaffected.

Local Magnetic Disturbance.

In Map No. 2 normal lines of equal value of the declination are recorded, and as far as the greater part of the globe covered by water is concerned, we may

accept them as undisturbed values, for we have yet to learn that there are any local magnetic disturbances of the needle in depths beyond 100 fathoms.

When, however, we come to the land, there is an increasing difficulty in finding districts of only a few miles in extent where the observed values of the magnetic elements at different stations therein do not differ more widely than they should if we considered only their relative position on the Earth as a magnet. Take Rücker and Thorpe's maps of the British Isles and those of the United States, for example, where the lines of equal value are drawn in accordance with the observations, with the result that they form extraordinary loops and curves differing largely from the normal curves of calculation.

From among numerous examples of disturbance of the declination on land, two may be quoted. In the Rapakivi district, near Wiborg, a Russian surveying officer in the year 1890 observed a disturbance of 180°, or, in other words, the north point of his compass pointed due south. At Invercargill, in New Zealand, within a circle of 30 feet radius, a difference of 56° was found. Even on board ships in the same harbour different results are sometimes observed, as our training squadron found at Reikiavik, in Iceland, and notably in our ships at Bermuda.

It is hardly necessary to add that the dip and force are often largely subject to like disturbance, but I do so in order to warn travellers and surveyors that observations in one position often convey but a partial truth; they should be supplemented by as many more as possible in the neighbourhood or district. Erroneous values of the secular change have also been published from the various observers not having occupied exactly the same spot, and even varied heights of the instrument from the ground may make a serious difference, as at Rapakivi before mentioned, and at Madeira, where the officers of the *Challenger* expedition found the dip at a foot above the ground to be 48° 46′ N.; at 3¼ feet above the ground 56° 18′ N. at the same spot.

All mountainous districts are specially open to suspicion of magnetic disturbance, and we know from comparison with normal observations at sea that those mountains standing out of the deep sea, which we call islands, are considerably so affected.

Magnetic Shoals.

The idea that the compasses of ships could be affected by the attraction of the neighbouring dry land, causing those ships to be unsuspectingly diverted from their correct course, was long a favourite theory of those who discussed the causes of shipwreck, but it was "a fond thing vainly invented." I can hardly say this idea is yet exploded, but from what has already been said about local magnetic disturbance on land, it is not a matter of surprise that similar sources of disturbance should exist in the land *under* the sea, for it has been found that in certain localities, in depths of water sufficient to float the largest ironclad, considerable disturbances are caused in the compasses of ships.

An area of remarkable disturbance having been reported as existing off Cossack, North-West Australia, H.M.S. *Penguin*, a surveying-ship provided with the necessary magnetic instruments, was sent by the Admiralty in 1891 to make a complete magnetic survey of the locality, with a view to ascertaining the facts and placing them on a scientific basis. An area of disturbance, 3·5 miles long by 2 miles broad, with not less than 8 fathoms of water over it, was found lying in a north-east by east and south-west by west direction. At one position the disturbing force was sufficient to deflect the *Penguin's* compass 56°; in another—the focus of principal disturbance—the dip on board was increased by 29°, and this at a distance of over 2 miles from the nearest visible land, upon which only a small disturbance of the dip was found.

This remarkable area of disturbance was then called a "magnetic shoal," a term which at first sight hardly appears to be applicable. We have, however, become familiar with the terms "ridge-line, valley-line, peak, and col," as applied to areas of magnetic disturbance on land; therefore I think we may conveniently designate areas of magnetic disturbance in land under the sea "magnetic shoals."

This year H.M. surveying-ship *Research* has examined and placed a magnetic shoal in East Loch Roag (Island of Lewis), but as all our surveying-ships are practically iron ships, it was impossible, from observations on board, to obtain the exact values of the disturbing forces prevailing in this shoal. The reason for this is that, although we may accurately measure the disturbing forces of the iron of the ship in deep water, directly she is placed over the shoal induction takes place, and we can no longer determine to what extent the observed disturbances are due to the ship's newly developed magnetism, or to what extent the shoal alone produces them.

We can, nevertheless, even in an iron ship, accurately *place* and show the dimensions of a magnetic shoal and the *direction* in which a ship's compass will be deflected in any part of it by compass observations only. Is it not, therefore, the duty of any ship meeting with such shoals to stop and fix their position?

The general law governing the distribution of magnetism on these magnetic shoals is that in the northern hemisphere the north point of the compass is drawn *towards* the focus of greatest dip; in the southern hemisphere it is *repelled*. The results at East Loch Roag proved an exception, the north point of the compass being *repelled*.

Terrestrial Magnetism and Geology.

I have already referred to the question of local magnetic disturbance as one of great importance in magnetic surveys. The causes of these disturbances were at one time a matter of opinion, but the evidence of the elaborate magnetic surveys I have alluded to, when compared with the geological maps of the same countries, points clearly to magnetic rocks as their chief origin.

Magnetic rocks may be present, but from their peculiar position fail to disturb the needle; but, on the other hand, as Rücker writes in his summary of the results of the great magnetic survey of the British Isles conducted by Thorpe and himself, "the magnet would be capable of detecting large masses of magnetic rock at a depth of several miles," a distance not yet attained by the science of the geologist.

Again, Dr. Rijckevorsel, in his survey of Holland for the epoch 1891, was convinced that "in some cases, in many perhaps, there must be a direct relation between geology and terrestrial magnetism, and that many of the magnetic features must be in some way determined by the geological structure of the underground."

During the years 1897–99 a magnetic survey was made of the Kaiser-stuhl, a mountainous district in the neighbourhood of Freiburg, in Baden, by Dr. G. Meyer. Exact topographical and geological surveys had been previously made, and the object of the magnetic survey was to show how far the magnetic disturbances of the needle were connected with geological conformations. Here, again, it was found that the magnetic and geological features of the district showed considerable agreement, basaltic rocks being the origin of the disturbance. This was not all, for in the level country adjacent to the Rhine and near Breisach unsuspected masses of basalt were found by the agency of the magnetic needle.

More recently we find our naval officers in H.M.S. *Penguin*, with a complete outfit of magnetic instruments, making a magnetic survey of Funafuti atoll, and assisting the geologist by pointing out, by means of the observed disturbance of

the needle, the probable positions in the lagoon in which rock would be most accessible to their boring apparatus.

Leaving the geologist and the magnetician to work in harmony for their common weal, let us turn to some other aspects of the good work already accomplished and to be accomplished by magnetic observers.

Magnetic Charts.

Of the valuable work of the several fixed magnetic observatories of the world, I may remark that they are constantly recording the never-ceasing movements of the needle, the key to many mysteries to science existing in the world and external to it, but of which we have not yet learnt the use. Unfortunately, many of these once fixed observatories have become travellers to positions where the Earth can carry on its work on the needle undisturbed by electric trams and railways which have sprung up near them, and it is to be hoped they will find rest there for many years to come.

Of the forty-two observatories which publish the values of the magnetic elements obtained there, thirty-two are situated northward of the parallel of 30° N., and only four in south latitude; and it is a grief to magneticians that so important a position as Capetown or its neighbourhood does not make an additional fixed magnetic observatory of the first order.

Thus, as far as our present question of magnetic charts and their compilation is concerned, the observatories do not contribute largely, but we should be very grateful to them for the accurate observations of the secular change they provide which are so difficult to obtain elsewhere.

Of the value of magnetic charts for different epochs I have much to say, as they are required for purely scientific inquiry as well as for practical uses. It is only by their means that we can really compare the enormous changes which take place in the magnetism of the globe as a whole; they are useful to the miner, but considerably more so to the seaman. Had it not been for the charts compiled from the results of the untiring labours of travellers by land and observers at sea in the field of terrestrial magnetism during the last century, not only would science have been miserably poorer, but it is not too much to say that the modern iron or steel steamship traversing the ocean on the darkest night at great speed would have been almost an impossibility, whereas with their aid the modern navigators can drive their ships at a speed of 26·5 statute miles an hour with comparative confidence, even when neither sun, moon, nor stars are appearing.

Of the large number of travellers by sea, including those who embark with the purpose of increasing our geographical knowledge of distant lands and busying themselves with most useful inquiries into the geology, botany, zoology, and meteorology of the regions they visit, few realize that when they set foot on board ship (for all ships are now constructed of iron or steel) they are living inside a magnet. Truly a magnet, having become one by the inductive action of that great parent magnet—the Earth.

How fares the compass on board those magnets, the ships, that instrument so indispensable to navigation, which Victor Hugo has forcibly called "the soul of the ship," and of which it has been written—

> "A rusted nail, placed near the faithful compass,
> Will sway it from the truth, and wreck an argosy"?

And if so small a thing as an iron nail be a danger, what are we to say to the iron ship? Let us for a moment consider this important matter.

If the nature of the whole of the iron or steel used in construction of ships were such as to become permanently magnetic, their navigation would be much simplified, as our knowledge of terrestrial magnetism would enable us to provide correctors for any disturbing effects of such iron on the compass, which would then point correctly. But ships, taken as a whole, are generally more or less unstable magnets, and constantly subject to change, not only on change of geographical position, but also of direction of the ship's head with regard to the magnetic meridian. Thus, a ship steering on an easterly course may be temporarily magnetized to a certain extent, but on reversing the ship's course to west she would after a time become temporarily magnetized to the same amount, but in the opposite direction, the north point of the compass being attracted in each case to that side of the ship which is southernmost.

Shortly, we may define the action of the Earth's magnetism on the iron of a ship as follows: The Earth being surrounded by a magnetic field of force differing greatly in intensity and direction in the regions from the north pole to the equator and the equator to the south pole, the ship's magnetic condition is largely dependent upon the direction of her head whilst building and the part of that field she occupied at the time; partly upon her position in the magnetic field she traverses at any given time during a voyage.

For the reasons I have given, magnetic charts are a necessity for practical purposes and in the following order of value. That of the magnetic declination or variation which is constantly in use, especially in such parts of the world as the St. Lawrence and the approaches to the English channel, where the declination changes very rapidly as the ship proceeds on her course. Next, that of the dip and force, which are not only immediately useful when correcting the ship's compass, but are required in the analysis of a ship's magnetism both as regards present knowledge and future improvements in placing compasses on board.

If astronomers have for a very long time been able to publish for several years in advance exact data concerning the heavenly bodies, is it too much to hope that magneticians will before long also be able to publish correct magnetic charts to cover several years in advance of any present epoch? If this is to be done within reasonable time, there must be a long pull, a strong pull, and a pull all together of magnetic observers in all lands, and accumulated data must also be discussed.

On Magnetic Instruments for Travellers.

Travellers in unsurveyed countries, if properly instructed and equipped, can do good service to science by observing the three magnetic elements of declination, inclination or dip, and force at as many stations as circumstances will permit; hence the following remarks.

For the purpose of making the most exact magnetic survey, the best equipment of instruments consists of the well-known unifilar magnetometer, with fittings for observing the declination, and a Barrow's dip circle. To some travellers these instruments might be found too bulky, and in some regions too delicate as well as heavy to carry.

Of suitable instruments made abroad, those used by M. Moureaux in his survey of France may be mentioned, as they are of similar type, but much smaller and lighter than the instruments above mentioned.

Another form of instrument, called an L.C. instrument, for observing both the inclination and total force, is shown in the instrument before you. Originally designed for observations on board ships at sea where the ordinary magnetic instruments are unmanageable, it has also been found to give satisfactory results in a land survey, where greater accuracy is expected than at sea. Thus, during

a series of observations extending from the north side of Lake Superior to the southern part of Texas last year, comparisons were made between the results obtained with an L.C. instrument and those of the regular unifilar magnetometer and dip circle, when the agreement was found satisfactory.

I am therefore of the opinion that a traveller, furnished with a theodolite for land-surveying purposes, but fitted with a reversible magnetic needle, can, at any time he observes a true bearing, obtain a trustworthy value of the declination. Dismounting the theodolite from his tripod, the latter will serve for mounting an L.C. instrument with which to observe the inclination and force. Thus, by adding to his ordinary equipment an instrument weighing in its box about 21 lbs., he can obtain valuable contributions to terrestrial magnetism, and at the same time give useful assistance to geological investigations.

Concluding Remarks.

Although a great subject like terrestrial magnetism, even to exhibit our present knowledge of the science, cannot be brought within the compass of an address—for it requires a treatise of many pages—I have brought some of the broad features of it before the section in order to show its connection with geography.

I also entertain the hope that geographers will become more interested in a subject so important to pure science and in its practical applications, and that it will become an additional subject to the instruction which travellers can now obtain under the auspices of the Royal Geographical Society in surveying, geology, botany, zoology, and meteorology.

There is a wide field open to observers, and where results often depend so much upon locality, we require to explore more and more with the magnetic needle. To look over the great oceans and think how little is being done for terrestrial magnetism is a great matter for regret. Yet even there we may begin to be hopeful, for the United States Coast and Geodetic Survey authorities are making arrangements to fit out its vessels with the necessary instruments for determining the magnetic elements at sea.

We wish them all success; but I must again remind you that, although we cannot compel observers to start, there is room for them and to spare.

I would fain make some remarks on the prevailing ignorance of sound geography in many quarters, and on the defective methods of teaching the science; but I feel that the subject is placed in very able hands, and will be fully discussed elsewhere during the present meeting.

REVIEWS.

ASIA.

Khotan.

'Sand-buried Ruins of Khotan.' By M. A. Stein. London: Fisher Unwin. 1903.

A most fascinating book has been written by Dr. Stein on his "finds" in the newly developed field of research in the Takla Makan desert of Chinese Turkestan—a book which will receive more than passing notice from orientalists all the world over. Only two explorers have been personally occupied in these investigations, the eminent traveller Dr. Sven Hedin and Dr. Stein, and their joint discoveries reveal to us a new phase of early mediæval Asiatic history.

A good deal of the book under review is devoted to a narrative of Dr. Stein's journey northward through Gilgit and Kashgar, which, although it is a well-told tale, adds little to our geographical or archæological knowledge. Incidentally he records his faith in the view taken by Lord Curzon of the Oxus source before the Pamirs were surveyed; but he is evidently unaware of the results of those surveys, which prove conclusively that one must look to the Nicolas range, rather than to the mountains at the head of the Ab-i-Panja, for the chief glacial sources of the great river. As a geographer, however, Dr. Stein has done much more than confirm previous records. He has added a great deal of excellent mapping to Asiatic topography about Khotan, sparing no trouble in his efforts to reach untrodden districts, and arming himself beforehand with all available data on which to base his own triangulation. He has thus succeeded in giving to every locality mentioned in his book an exact value in geographical position such as many of them never possessed before. He was much assisted by the pre-existence of Captain Deasy's work, based on the Pamir surveys, and he wisely secured the services of a professional native topographer from the Survey of India.

From the geographical point of view Dr. Stein's work is most valuable; but, of course, the chief interest of his book lies in his archæological discoveries.

Following the indications left in the records of Chinese pilgrims in early times, and greatly helped by the courteous and kindly sympathy of Chinese officials in Kashgar and Khotan, he has been enabled to lay before the world something of a consecutive story of the social and commercial conditions of a great part of the world's highway between East and West as it existed in the days when Buddhism prevailed throughout these regions, ere the tide of Islam had swept through High Asia. Whilst generally confirming the observations of Sven Hedin, he has added immensely to their value by the completeness of his examinations of Buddhist sites, and the discovery of a most extraordinary wealth of early literature. Chiefly in the form of inscribed wooden tablets (but partly on leather) there are records referring to passing local subjects of interest written in several languages. Of these Karosthi is the principal (an early Indian Prakrit, containing Sanscrit terms), but there are also writings in an archaic form of Tibetan, in Chinese, and in Brahmi, dating from the Indo-Scythic period of the early centuries of our era; and (so far as they have been translated) they certify to the existence of well-ordered and flourishing communities in this desert, the incidents of whose daily life routine was not so very different from those which we may observe in the same regions now. Greek influence, as exhibited in seal-cuttings and sculptures, is just as evident there as in Northern India; nor is this surprising, seeing that Khotan was conquered by Indians from Taxila about a century later than the conquest of Taxila by Alexander. Karosthi was the language of Taxila, and Kushana kings ruled the north-west of India for the first two centuries A.D.

Not the least valuable of Dr. Stein's investigations was connected with the exposure of a most comprehensive system of forgeries, which has supplied the archives of certain European museums with specimen writings in "unknown" characters. These forgeries were perpetrated by a clever native at Khotan, which place appears recently to have rivalled Rawal Pindi as the seat of ingenious inventions in this particular line.

It would have added to the interest of Dr. Stein's work if he had more to say about such relics as exist of the peculiar form of Nestorian Christianity which once prevailed in High Asia, and was coæval with Buddhism. But there is very little more light thrown on this subject than has already been given us by Sven Hedin.

Scientists will await with impatience the fuller records of his discoveries, and the splendid field of philological research to which they give rise. Meanwhile, the

ordinary unscientific public will find a most readable summary of these important investigations (which illustrate quite a new chapter in human history) in the book which has just been published. T. H. H.

India in Early Maps.

'La Cartografia antica dell' India.' By Francesco L. Pullé. Firenze, 1901. (In *Studi Italiani di Filologia Indo-Iranica*, Anno IV. vol. iv.) With an Atlas of Maps.

This is a study of high interest and value. It is divided into seven parts, in which the conceptions of India and its configuration are discussed, as entertained by the ancient Egyptians, Babylonians, Phœnicians, and Jews, by the Indians themselves, by the Greeks, by the Romans and Alexandrians, by the scholars of the 'Lower Empire,' by the Byzantines, and by the Arabs and Persians. Appendices are added on certain special authors or treatises and their account of India—on Pomponius Mela, on Pliny, on the Periplus of the Erythræan sea, on the Anonymous Geographer of Ravenna, and others. Among the larger maps in the 'Atlas' are facsimiles of the sixth-century world-scheme of Cosmas Indicopleustes, according to both the Florentine (Laurentian) and Vatican manuscripts of the ninth and tenth centuries—of the same author's Mountain of the North, according to the Laurentian manuscript—of the Mappe-monde of Fra Mauro (1457–1459), etc. The text is also illustrated by thirty-seven smaller designs, largely modern reconstructions of ancient maps now lost; many of these, as is natural, follow the suggestions already given by that most stimulating inquirer, K. Miller of Stuttgart. Several clarified reproductions of mediæval maps, admirably executed, are also given, *e.g.* Cosmas, the Mappe-monde of Albi, Ibn Haukal, and Edrisi. The whole work is executed in a thorough and scholarly manner, and must be invaluable to every student of mediæval geography; the most recent work of continental scholars has been utilized, though the same cannot always be said of their English contemporaries. It is pleasant, however, to see so keen an appreciation of an essay of remarkable merit, too little known in England, Marinelli's 'La Geografia dei Padri della Chiesa,' long ago translated into German ('Die Erdkunde bei d. Kirchen-Vätern'), but still awaiting an English version. The treatment of India by Ptolemy, by the Periplus of the Erythræan sea, and by Cosmas, are handled by Sig. Pullé in a manner worthy of special praise. This is surely the first time that the world-scheme of the Alexandrian monk has ever been faithfully reproduced from the Vatican manuscript; it had already been photographed in 1897 from the Florentine copy, for reproduction in my own 'Dawn of Modern Geography,' vol i. p. 384. C. Raymond Beazley.

Persia.

'The Persian Problem.' By H. J. Whigham. London: Isbister & Co. 1903. *Price* 12*s.* 6*d.*

Under the above title Mr. Whigham republishes, in an altered and amplified form, with maps and illustrations, a series of letters contributed by him in 1901–1902 from Persia to the *Morning Post*. The sub-title of the book, "An examination of the rival positions of Russia and Great Britain in Persia, with some account of the Persian Gulf and the Baghdad railway," is a sufficient indication of the object with which it is written. In some of the first twenty-two chapters Mr. Whigham deals mainly with various factors of the Persian problem, *e.g.* our position and prestige, past and present, in the Persian Gulf, Koweit, and the Baghdad railway, the attitude of his predecessors and of the present Sheykh of Muhammerah towards the Persian Government, the trade-routes from the Karun to the capital,

and the equally important route *viâ* Baghdad and Kermanshah; in others he sketches with a crisp touch the Arab pirate coast, the ruins of Mesopotamia, the sacred cities of Nejef and Kerbelá.

Mr. Whigham has the faculty of presenting in concise and well-chosen phrases a luminous *résumé* of any subject he deals with, whether that subject be a somewhat intricate question of local politics (*e.g.* in the case of Muskat) and its bearings on international questions, or the reconstruction of the Babylon of Nebuchadnezzar's day, as seen in the light of the most recent discoveries of Dr. Koldwey and his fellow-workers, or, again, the exploitation by a British capitalist of the oil-wells of Kasr-i-Shirin.

In the closing six chapters Mr. Whigman sums up the relative positions, political and commercial, of Russia and Great Britain in Persia, and draws his conclusions. "The whole aim and object of our policy in Persia, first and last, should be railways. Russia may have all the political prestige she wants, so long as we control the railways from the Gulf to Tehran."

Since the publication of Lord Curzon's 'Persia' we have seen no work more helpful than Mr. Whigham's for a right understanding of the Persian question. Indeed, it is not too much to say that the volume forms a useful and almost indispensable supplement to that book, bringing it up to date on many points.

G. G.

Formosa.

'The Island of Formosa, Past and Present.' By James W. Davidson, F.R.G.S., Consul of the United States for Formosa. London: Macmillan & Co. 1903.

Formosa must have been known to the Chinese at a period far beyond the ken of European historians; it is potentially one of the richest islands in the world, and the Dutch settlements upon it were founded so long ago as 1624. Yet, on the whole, the bibliography of the island is a remarkably limited one, and no really comprehensive work on it has been published in any language. In the volume under consideration Mr. Davidson seeks to remedy this omission, and, though it is very far from being complete, as the author himself would probably be the first to admit, it is, at all events, a step in the right direction, and for the large amount of really valuable information which he has got together, whether from his own experiences or those of others, the reader cannot be otherwise than grateful.

Of Mr. Davidson's thirty-one chapters no less than twenty-two are devoted to historical events. Chinese records furnish but few particulars as to the earlier periods, and in later times the Portuguese seem to have been content with naming the island only, for they made no settlements on it. It is with the advent of the Dutch that history really commences, and their occupation and final ejection by Koksinga are treated at some length, as is also the episode of the first Japanese expedition in 1874. The most important, and certainly the most interesting section of the historical part, however, is that descriptive of the Japanese campaign of 1895, which ended in the annexation of the island. Here we have an account of the affair at first hand, for Mr. Davidson was an eye-witness of the reign of terror which prevailed in Taipeh and Twatutia, and, indeed, took a sufficiently prominent part in the events of this most perilous and exciting time to earn him the decoration of the Imperial Order of the Rising Sun at the hands of the Emperor of Japan.

Leaving history for present-day conditions, Mr. Davidson passes to a consideration of the three great industries of the island—tea, camphor, and sugar, to each of which a chapter is allotted. Tea culture is principally confined to the

northern part, in the neighbourhood of Taipeh, or, as it is now called, Taihoku, and here it appears to be increasing enormously. The output already exceeds twenty million pounds, but is regarded by good authorities as being still in its infancy, and the quality is of distinctly high average. The importance of the industry may be estimated from the fact that about 86 per cent. of the annual export receipts are obtained from it. Camphor, however, is scarcely less important, although the Government monopoly of the article has not quite proved the success which had been predicted. The increased price obtained led to the cultivation of the tree in other countries, while in Japan the camphor is to be found wild, and in the central and southern provinces of China it abounds, giant trees of 28 feet in circumference being met with. As a result, private individuals were able to undersell the Government, and prices had to be lowered.

The author, seeing that his aim is to make his volume a standard book of reference on the island, might, perhaps, have given the list of Formosan plants which Mr. Augustine Henry published in the *Transactions of the Asiatic Society of Japan*, but he has contented himself with dealing with the economic species cultivated in the island, and of these he furnishes a full account, as in the case of camphor, of which, indeed, the most minute particulars are given. The Japanese Government has been particularly energetic in forwarding agricultural interests, and has already established several experimental stations. The coal measures of Formosa apparently underlie the whole island, and sections descriptive of these, the petroleum, salt, gold, and other mineral products, are appended; but geology as such receives but scant notice at Mr. Davidson's hands. Nor does ethnology fare much better, for though some thirty pages are given to the aboriginal tribes, and Mr. Y. Ino, to whom the author tells us he is mainly indebted for the particulars, has much that is new and interesting, he leaves so much unsaid, that there is evidently no lack of work for future travellers desirous of investigating the anthropological problems of the country. Eight groups of these savages are described, and vocabularies of some forty words of each given in the appendix. It is curious to note, with the exception of the numerals, how slight is the resemblance to Malay. The types of natives, too, so far as can be judged from the very indifferent illustrations, show no likeness to Malays, and the chief feature about them would seem to be—as, indeed, might be expected—the amount of variation. Rather remarkable is the approximation to a Carib *facies* which is noticeable in a number of instances, an *obiter dictum* which we may permit ourselves here without making suggestions as to its cause. Quite one of the most interesting parts of the volume is that in which Mr. Davidson describes the little-known island of Botel Tobago and its inhabitants, which he visited in 1896. He considers that there is a distinct admixture of Papuan blood here, and doubtless there is. But the same might be said of some, if not all, of the Formosan wild tribes, among whom are to be found bachelor houses for the young men, anthropomorphic images, and bows and arrows. Botel Tobago is one of the few places on the globe where tobacco is unknown, and other peculiarities are the dwellings of the natives, and a remarkable breed of long-nosed pigs with long hair on the neck. The houses may be said to be unique. They consist of three separate apartments within a walled and paved compound, one being partly subterranean for winter residence, another a tower-like edifice for protection against the summer heat, and the third of an intermediate nature.

Mr. Davidson concludes with a long chapter on "Formosa of To-day," which deals with the present condition of affairs at some length. That the information is the most recent possible is evident from the fact that his book is written on the spot. It thereby suffers somewhat, the author having been unable to revise the

proofs; but the errors are of no great moment. There is a useful appendix on the land birds of the island by Mr. J. D. de la Touche, but the list of mammals is apparently the same as Swinhoe's. Some notes on the climatology follow, from which it appears that Kelung has the heaviest rainfall of any station in the Far East, its average for five years past being 219 rainy days, and over 150 inches of rain. The book is illustrated by a number of quarter-plate photographs, in favour of which not much can be said. The two maps are noteworthy as embodying the latest Japanese explorations, and there is a commendably full index of forty-six pages. F. H. H. G.

THE MONTHLY RECORD.

EUROPE.

The Lakes of Snowdonia.—A survey of the principal lakes of North Wales, mostly situated in or near the Snowdon district, was carried out in 1900 by Mr. T. J. Jehu, late Heriot Fellow of the University of Edinburgh, and this supplies us for the first time with accurate data regarding the under-water contours of most of the lakes, thus doing an important service towards the elucidation of their mode of origin. The results of the survey, with a summary of conclusions based upon them, are given by Mr. Jehu in the *Transactions of the Royal Society of Edinburgh* (vol. xl. part 2), in a paper which, though issued separately in June of last year, has only lately been received in the collected volume. Mr. Jehu begins by sketching previous work of the kind done in this country, and pointing out the importance of a knowledge of the configuration of lake-basins for the solution of the vexed question of the extent to which they can have been excavated by glaciers; afterwards explaining his method of work, describing in turn the individual lakes and their surroundings, and summarizing their general characters and the conclusions to be drawn as to their mode of origin. The method was, on the whole, identical with that employed by Dr. Mill in his survey of the English lakes, rowing-boats and cord sounding-lines being used. The transport of the boats to some of the elevated and remote mountain lakes was a matter of some difficulty, and Mr. Jehu is to be congratulated on his successful accomplishment of the work in spite of such obstacles. During a great part of the time he was single-handed, but a portion of the survey was carried out with the help, firstly of Mr. P. Lake, secondly of Mr. H. Woods, both of St. John's College, Cambridge. We can refer particularly only to the two last sections, in which the main generalizations arrived at are put down. The general summary of the characters of the lakes, which is accompanied by tabulated statistics of the various elements in each of them, shows that five of the lakes lie at comparatively low levels in valleys encircling the base of Snowdon, though their positions within the valleys differ considerably. Others occur more or less close to the heads of upland valleys, while others belong, again, to the class of cirque, corrie, or cwm lakes. Examples of shallow, intermediate, and deep lakes alike exist, and it is noted that the deepest lakes often occur at very high elevations, some of the corrie lakes lying in crater-like hollows. Of the valley lakes, Cawlyd (maximum depth over 200 feet; mean over 100), Peris, and Cwellyn exceed 100 feet in depth. Padarn, Peris, and Cwellyn lie in trough-like hollows, while other valley lakes show more basin-shaped cross-sections. The deepest portion of lakes of this class, as has been so often found elsewhere, frequently lies towards the head. In regard to the mode of origin, Mr. Jehu has no doubts as to the power of ice to excavate lake-basins, and accepts without reserve the views of

Penck and Davis as to the "over-deepening" of main valleys by ice as the explanation of the existence of hanging valleys.* His soundings, which have shown that in many cases the lakes are deeper than has been supposed, certainly seem to prove that a number of them are true rock-basins, and that they are not, as Mr. Marr suggested, bounded in part by drift-filled depressions. But his explanation of the mode of action of the ice is not always convincing, and savours sometimes of a *petitio principii*. Thus it is assumed throughout that where the ice accumulated above an obstacle a deepening of the valley would result, no attempt being made to remove the difficulties many feel in accepting this as proved.

The Relict Fauna of the Furesö, Denmark.—The Furesö lies north-west of Copenhagen at a distance of 5½ miles from the Sound on the east, and 10 miles from the Roskilde fiord on the west. It has an area of more than 2400 acres; its surface lies 66 feet above sea-level, and its bottom 62 feet below. On most sides it is bordered by hills rising to a height of about 65 feet above the water. The little lake Vejlesö has been cut off from the lake, and the large gulf of the Furesö, the Store Kalven, is undergoing the same process of separation. The chief affluent of the lake is the Mölleaa, 24 miles long, which, after passing through the Furesö and other lakes, enters the Sound. Much of its water is drawn off for use in factories, and the bed is silting up. Dr. C. Wesenburg-Lund has found in the Furesö a relict fauna consisting of two groups, the earlier of arctic origin and including *Mysis oculata* var. *relicta* and *Pontoporeia affinis*. Since the discovery of an arctic marine fauna in the Swedish lakes by Messrs. Cederström and Videgren in 1860, there has been much discussion regarding relict lakes, some naturalists maintaining that every lake containing a pelagic fauna must have had direct communication with the sea during some period of its existence, and have been subsequently cut off by an elevation of the land, whereupon the marine fauna has gradually adapted itself to life in fresh water. M. de Geer, however, affirms that the modification of marine forms took place in a large lake, which towards the end of the glacial period occupied the basin of the Baltic, and was gradually shut off from the ocean; while Prof. Credner points out that in many cases marine organisms have ascended rivers and traversed lagoons, gradually adapting themselves to new conditions on their way to the fresh waters in the interior. Proof that a lake has formerly formed part of the ocean must be furnished by geology. With regard to the Furesö basin, Dr. Wesenberg-Lund concludes that, whatever its origin, it had received its definite form when the beds containing *Dryas* and other polar plants were deposited, and was not sensibly modified during the successive vegetations of the birch, pine, and oak. The oldest representatives of a marine fauna (*Valvata*, *Bithynia*, etc.) date from an epoch long before the glacial period, and their origin is quite unknown. Two forms, at least, *Mysis oculata* and *Pontoporeia affinis*, probably accommodated themselves to fresh water in the Baltic when that sea was the *Ancylus* lake, and survived in the inland lakes when salt water again penetrated into the Baltic. Immigration took place at first both from the west and east coasts, but ceased on the west during the oak period, when the sea retired from the deep erosion valleys, while on the east it continued till interrupted by the action of man. The other marine forms in the Furesö have probably immigrated in more recent times.—*K. Danske Vidensk. Selskabs Forhandl.*, No. 6, 1902.

* Hanging valleys are generally attributed to the protection afforded by the ice which is supposed to have formerly filled them. May not some at least, however, be due to the protective action of the ice in the *main* valley, which would temporarily raise the base level of erosion, in their case, to that of its own surface, at the same time preventing the accumulation of *débris* on the valley-flanks below that level?

Ignazio Danti's Map of Perugia and District.—A photographic reproduction of the map of the district of Perugia, drawn in 1577 by the Italian cosmographer, Padre Ignazio Danti, appears in the *Bolletino* of the Italian Geographical Society for April-May last, accompanied by letterpress by Prof. A. Bellucci. The map, which is now the property of Colonel C. Cherubini, was based on a survey by Danti himself, and is one of the earliest examples of Italian local topographical maps in existence, while a further interest attaches to it on account of its author's services to geography in other directions. Prof. Bellucci says less than could be wished as to the circumstances which led to the production of the map (which was engraved by Castari in 1580), but as he is preparing for press a detailed work on early Italian topography, more will no doubt be said on this subject later. He also says little as to Danti's other work as a geographer, and as this is perhaps less familiar to the public than that of other Italian geographers of the time, a few notes on the subject may not be out of place here. Danti is best known from the part which he took in the preparation of some, at least, of the maps painted on the walls of the Logge di Raffaello at the Vatican, which include an important one of Italy as it then was. He did this work in the capacity of cosmographer to Pope Gregory XIII., whose interest in geographical studies is well known. (For a description of the maps see Thomassy's series of articles on "Les Papes Geographes" in the *Nouvelles Annales de Voyages* for 1852–53.) He also designed the maps painted in the "Guardaroba" of the Palazzo Vecchio at Florence, which, like most of those at the Vatican, bear a strong resemblance to the sets of maps given in contemporary Italian versions of Ptolemy. In an allied field Danti did important work in connection with the revision of the calendar and the construction of the first gnomon capable of being used for astronomical observations, while his name has been drawn into the recent discussion on the Toscanelli-Columbus correspondence from an erroneous statement which he made on the subject in his edition of the *Sphæra Mundi* of Sacrobosco. In connection with Danti's map of Perugia, Prof. Bellucci gives information as to various old lists of forts and towns in the district, one of which, dating from 1580, or the year in which the map was engraved, he gives in full for purposes of comparison.

ASIA.

Mining and Forestry in Asiatic Turkey.—A recent consular report, printed by the Foreign Office (Miscell. Series, No. 589) gives some interesting details respecting the present condition of mining and forestry in Asiatic Turkey. It deals with the various provinces in turn, passing under review the principal mines and known deposits of minerals in each, as well as the extent of forests, the methods of working them, and the principal trees represented. Taking the mines throughout the whole territory first, we note that while everywhere a great variety of useful minerals appears to exist, the conditions of the country at the present day are such that few of the deposits can be worked with much prospect of financial success. The hindrances to mining enterprise in the vilayet of Sivas are summed up as "lack of capital, bad roads, absence of cheap transport, and unfavourable Government attitude," and these conditions seem to apply with greater or less force throughout the country, though in some districts, as, *e.g.*, in the Adana vilayet, carriage does not present quite the same difficulties, the most serious obstacle being the present state of the administration and mining laws. The minerals most commonly spoken of are chrome, silver-lead, antimony, manganese, arsenic, emery, copper, iron and iron pyrites, silver, zinc (calamine), coal, though many others also occur. In the Smyrna consular district the most active workings are of chrome, emery, calamine, and silver-lead, the principal ports of shipment being

Smyrna, Makri, and Kulluk. Other minerals which exist, but are at present worked in small quantities, if at all, are manganese, arsenic, copper, iron, lignite, etc. Chrome, silver-lead, and manganese are worked in the Adana vilayet, silver-lead in that of Sivas, bitumen in Syria, while in the vilayets of Aleppo, Erzerum, Trebizond, little is yet done to exploit the mineral wealth, though in the last-named coal must before long be more extensively worked in view of the almost entire absence of other fuel-supplies. With regard to forestry, while neglect and mal-administration seem fairly general, the condition of the forest differs much in the different vilayets. In that of Aidin (Smyrna), their area is estimated at 2½ million acres, the principal trees being pine (*Pinus sylvestris*), oak (*Quercus pedunculata* and *Q. robur*), styrax, larch, etc. In the Sandjak of Adalia they cover nearly 900,000 acres, the pine being here the *Pinus maritimus*, which occurs up to 1500 feet. The forests are, however, in general little worked, and the Smyrna timber market is mainly supplied from abroad. The forests of Murad Dagh and Aghar Dagh in the vilayet of Brussa, and of Kaz Dagh, which extend beyond the limits of that vilayet, are very valuable, and offer good facilities for working. Those of Mount Amanus, in the Aleppo vilayet, produce noble specimens of "Aleppo pine" and fir; while the rich and extensive forests in the vilayet of Adana still produce magnificent timber, though the cedars of the Cilician Taurus are fast being exterminated. The forests of Lebanon have been considerably reduced by improvident cutting, which the Government can do little to prevent, and in the vilayet of Beirut the fine forests which existed thirty or forty years ago are rapidly disappearing. In Erzerum, again, the denudation is all but complete in the eastern portions, the poplar and willow plantations around the villages alone remaining. In the Trebizond vilayet, forest covers nearly 1½ million acres, but the two saw-mills which have been established have not proved very profitable.

Exploration in Mongolia.—According to a telegram from the *Times* correspondent in Peking, dated September 18, an interesting journey in Mongolia has been made this summer by Mr. Claude Russell, second secretary of the British Legation, accompanied by a son of Sir Michael Hicks-Beach. The expedition left Peking on July 20, and, passing through Jehol, struck north to the Manchurian railway at Tsitsihar. The route lay east of the Khingan range, and covered a distance of 1000 miles, parts of it being, it is thought, through country previously unvisited by Europeans. It will thus form an interesting supplement to Mr. Campbell's recent journey, though it is hardly to be expected that the new geographical matter can be very extensive, coming from a country which has been so frequently visited by Russian explorers. The party met everywhere with a most cordial reception.

Recent Visits to Lhasa.—In 1899 the Council of the Imperial Russian Geographical Society provided O. M. Narzunof, a Kalmuk by birth and a Buddhist by religion, who was going to Lhasa, with a camera and a number of plates. At the same time the Buriat Zibikof was also in Lhasa taking photographs for the Society. Lists of their views are given in the *Izvestiya*, vol. xxxix.—published also under a separate cover—and seven of Narzunof's views are reproduced, showing Lhasa, the Potala or palace of the Dalai Lama from various points, the palace of the old kings of Tibet, and a couple of monasteries. Lhasa has also been reached by a Japanese named Kavagushi, who, leaving home six years ago, spent some time at Darjiling learning the Tibetan language, and was thus able to pass for Lama and live on intimate terms with some of the most influential personages in the city. His disguise was at last detected, but he made his escape through the aid of a friend.

First Ascent of the Volcano Mayon in the Philippines.—This famous

volcano was ascended to its summit for the first time last year by two out of a party of five Americans who started from the village of Guinobaton on the afternoon of March 15. A short account of the ascent appears in the *Sierra Club Bulletin* for February of the present year. The night was passed at an elevation of 1500 feet, and the actual ascent began at 5.30 on the morning of March 16, the way leading up a narrow trail through dense tropical vegetation. At 9.30 the party reached the edge of a deep gorge, beyond which there was no vegetation, the slopes above alternating between rock and shifting sand, with frequent deep gorges. At 11 a.m. an altitude of 6500 feet had been gained, and here one of the Americans gave up the attempt, a Spanish doctor, who set out with them, having previously desisted. The slope became excessively steep, and the mountain was now a conglomerate of lava and great boulders, quite devoid of life. At 1000 feet below the summit two more of the party desisted, leaving two only—Lieut. Barton and Mr. Bubar—to continue the ascent to the summit. During the last 250 feet the top of the mountain had been rent into hundreds of clefts and holes, through which steam constantly escaped. The highest point is 8900 feet above the sea, the edge of the crater being a mass of black volcanic sand and pumice, with outcrops of white and red rock. The crater is about 200 yards in diameter, and at a depth of 100 feet the vent decreases to 50 feet, the steam escaping as though under pressure.

Further Explorations in Celebes by Messrs. Sarasin.—The energetic explorers of Celebes, Messrs. Paul and Fritz Sarasin, have added to their previous exploits the crossing of the hitherto almost unknown south-eastern peninsula of the great island. In 1902, it will be remembered (*Journal*, vol. xxi. p. 454), Messrs. Sarasin had made an important journey across the western centre of the island, and their latest expedition was undertaken early in the present year. Starting from Mingkoka bay in the Gulf of Boni on February 20, they struck eastward, and reached the Bay of Kendari on the East Coast on March 12, after a successful journey. According to a note in *Globus* (vol. 83, No. 22), the main physical features of the peninsula are as follows: Both on the east and west sides a system of mountain chains runs nearly north-west and south-east, sinking to sea-level in the south, but joined northwards to the high chains of the Sussua and Tobungku mountains respectively. A trench-like depression between them is partly occupied by a vast swamp, Lake Opa, which is drained by the large river Konaveha. This rises in the north, and breaks through the eastern range to the Bay of Sampara. The valleys of the western range were flooded by the heavy rains, and the travellers had frequently to wade through the water. Reaching Lambuya, at the eastern foot of the mountains, they went south to the Opa swamp, and then struck north-east across its northern extension, a deep sago-palm morass, through which they had to wade for three hours, afterwards crossing the eastern chain and the Konaveha river. Among the slaves of the Buginese on the west coast, a low type of natives was seen—dark, broad-nosed, and of low stature—said to come from the island of Muna. In the interior the people were likewise of small stature, but light in colour, and having often the characteristic Malay eyes. Nearer the East coast dwell the Tolalaki, a much-dreaded tribe of head-hunters of Toraja affinities, big-made men, resembling the Buginese. Ethnological research was, however, hindered by the general flight of the people through fear that the expedition was a warlike one. Evidence is said to have been obtained that no former land connection existed between the south-east peninsula and neighbouring lands, as was the case with the other peninsulas.

AFRICA.

Hydrography and Economics of the Nile Basin.—As the fourth number of a new German series of monographs on 'Applied Geography,' edited by Prof.

Karl Dove ('Gebauer-Schwetschke Druckerei,' Halle a. d. Saale, 1903), Dr. H. Henze has written an elaborate account of the hydrography and economic relations of the Nile. The writer has consulted a large number of authorities, and although there is nothing very original in his point of view, it is useful to have the main facts thus brought together in a convenient form. The study would, however, have been of more value if more care had been taken to make use of the latest available information. The main sources have certainly been drawn upon down to some three years ago, but there is a surprising absence of reference to some of the latest authorities, at any rate at first hand. Thus the official reports of the Egyptian department of public works, which contain so much valuable information on irrigation, hardly appear to have been consulted, though copious reference is made to Sir W. Willcocks's work on irrigation in Egypt, which of course embodied much of the information down to the date of its publication. In describing the hydrography of the Nile, Dr. Henze follows in the main the lines of the paper by M. de Martonne in the Berlin Society's *Zeitschrift* for 1897 (see *Journal*, vol. xi. p. 548), to which he often refers, but he has left out of view much of the work that has been done since. In describing the headstreams of the Nile, he, strange to say, makes no allusion to Dr. Kandt's surveys of the upper branches of the Kagera (to say nothing of M. Dècle's examination of the southern branch), nor when speaking of the *régime* of the Victoria Nyanza does he make any mention of the observations of level carried out in Uganda and discussed in the British Association Reports on the Climatology of Africa; while the rainfall data for Uganda contained in the last of these (1901) have also not been consulted. The results of Commander Whitehouse's survey of the shores of the Victoria lake are ignored, and valuable papers like that of Captain Herrmann in Danckelmann's *Mitteilungen* for 1899 are not alluded to. Probably the paper was written before the publication, in the *Annales de Géographie*, of Captain Dyé's important paper on the Bahr-el-Ghazal system, but we should have expected fuller information to be given respecting the results of the recent sudd-cutting operations. Of the earlier authorities good use has been made, and the copious references to these which are supplied will be a help to those who desire to pursue the subject further. In the section dealing with the economic importance of the Nile, the want of up-to-date information is not so noticeable, and the paper supplies a useful summary of the part played by the river in relation to agriculture and communications in Egypt and the Sudan.

The Okapi.—It is pointed out by P. Hesse in the *Naturwissenschaftliche Wochenschrift* for July 12 last, that the skin of an unknown animal was obtained by Junker when at Zemio, in the Welle basin, under the name Makapi, and the plausible suggestion is made that this really came from a young individual of the recently discovered okapi. The skin was devoid of head and feet, so that its accurate determination was impossible. The size was that of a dwarf antelope, but the colour was reddish-brown, with dark tips to the hairs, and bands of white from the neck to the flanks. The animal was known to but a few of the A-Zande, and its habitat was said to be a swampy tract in about 6° N., 25° E., or not far distant from the equatorial forest. The swampy nature of the habitat seems certainly to favour Junker's identification with the *Hyæmoschus aquaticus* of the dwarf musk-deer group (*Tragulus*), or an allied species, rather than with the okapi, while the resemblance of the name and the locality from which it was obtained lend some support to Herr Hesse's suggestion. Junker's account of his animal is to be found in vol. iii. of his 'Travels in Africa' (German ed., p. 299; English ed., p. 268).

Disappearance of Lake Shirwa.—The drying up of Lake Shirwa, or Chilwa, which, as is well known, has been in progress for some years, seems now to be virtually complete, to judge from a note inserted in the missionary publication

'Life and Work in British Central Africa' for June last. All that can now be seen of it from the former Mchisi island is a pool at the old crossing on the west side, and small shallow pools at the mouths of the large streams. The canoes which the natives have used on the lake from time immemorial are left high and dry on the sun-baked mud, while it is possible to go on foot to Tongwe, the smaller inhabited island. The mud is still soft in places, but the surface quickly dries hard, and the grass which has sprung up is dry and yellow, and grass fires constantly occur. A small well near the mission school on the island supplies the natives round with water, which is good, although the lake-water is or was brackish. Food-crops on the island are very poor on account of the drought, and many of the people are emigrating to the Zomba district.

The Lower Ogowé Country.—It is probably not sufficiently realized to what extent our knowledge even of districts close to the African coasts or well-frequented routes into the interior lacks accuracy and precision as regards the details of their topography. The lower Ogowé is a case in point, for, as is shown in the *Annales de Géographie* for March 15 last, by Mr. Ernest Haug, a missionary who has spent a number of years in the country, existing maps of this region are entirely inaccurate regarding all but the main course of the Ogowé itself, the complicated system of lakes and interlacing streams connected with it being very little known. Mr. Haug has, during his frequent journeys, paid special attention to the topography of the district, and gives the results in the form of notes, accompanied by an excellent map, in the Journal above alluded to. Mr. Haug's map is referred to the longitude of Lambarene accepted in the official map of the Service Hydrographique (though, as he points out, its correctness is not quite certain), the details being filled in from his compass surveys, made, as a rule, in closed circuits. One of the principal geological formations, especially to the north of the main river, consists of horizontal strata of calcareous (sometimes sandy) marl, which seem probably of Upper Cretaceous age, though the surface in the direction of the sea is composed of sandy savannas, presenting parallel undulations which have all the appearance of having once been dunes since fixed by the growth of *gramineæ*. The borders of the southern lakes, and of the Ogowé itself, are formed of laterite, which has been erroneously supposed to occupy the whole region. A study of the orographical features is extremely difficult on account of the dense covering of vegetation and the entire absence of paths. Generally speaking, the elevations of the surface run in lines parallel to the coast, the lacustrine region lying between the Lambarene range (highest point 800 feet), which is connected towards the south with the Ntyankolo mountains, and the coast ridges. After passing through the Lambarene range the Ogowé sends off divergent arms, which, before again uniting with the main stream, collect the water of two principal series of lakes, one to the north, the other to the south. The former is still little known; the latter consists of the three lakes of Onange, Ogemwe, and Ezanga (with a few smaller ones), forming together a basin of very irregular outline, which has hitherto been very incorrectly shown on our maps. The streams which connect the lakes with each other and with the Ogowé are deep and of a generally uniform width and current, while the main river varies greatly in width and is often blocked by sandbanks. The lakes form a system of natural regulators of the flood-water of the Ogowé, which sometimes reverses the current in the outlet of the southern lakes, the level of the latter then rising rapidly. Apart from the so-called plains of the coast region, the whole country is covered with dense forest, in which animal life (including the gorilla and chimpanzee) is fairly abundant, though not often seen. The human inhabitants, who came originally from the interior plateaus, have become thoroughly acclimatized to this region of lakes and rivers, and hardly travel at all

except by water; but though their villages are always placed near the water, care is taken not to remove too far from the rising grounds on which the plantations are made. They may be divided into three main groups, viz. those of the Seki and Bakele, the Mpongwe, and the Pahuins, or Fan, which correspond to three successive immigrations.

The Oranese Sahara.—The well-known French geographer, M. E. F. Gautier, who has done so much to extend our knowledge of Madagascar from a scientific point of view, undertook last year a journey into the western part of the Algerian Sahara, lately brought under French influence. The results of his studies, which are a valuable addition to our knowledge of the physical history of the region, are summarized in the *Annales de Géographie* for May 15 last. M. Gautier says that the Sahara proper may be held to begin a little to the south of Figig, which itself belongs rather to the Atlas. The Wed Zusfana, which runs south-west from Figig, soon enters a region dominated, in contrast to the jagged summits of the Atlas (of Secondary age), by horizontal plateaus of carboniferous limestone, which constitute the horst against which the northern chain has been folded. In its upper, wider part the valley forms a level plain of quaternary alluvia, into which the water sinks, so that not a single oasis exists, the only trace of former occupation being at the northern edge. Lower down the valley narrows, and we find a group of oases, of which the largest is Tarit, brought into being by the outcrop of the impervious carboniferous limestone, which brings to the surface the excellent water contained in the great dunes to the east. This region shows abundant signs of ancient habitation. Before Igli is reached the horizontal quarternary strata reappear, though pierced by "gur" of carboniferous limestone, on one of which the post itself is placed. Igli owes its importance to its position just below the junction of the Zusfana with the Gir, from the latter of which it derives most of its water-supply. M. Gautier urges the advantages of the valley of this wed over that of the Zusfana as the route for the future railway, its people showing signs of much relative prosperity, besides being generally amenable to authority. A little beyond Igli a new geological region is again reached, the character of which has not been sufficiently recognized. It differs in the age and character of its rocks, which are Devonian, but still more in the presence of an important series of folds, which leads M. Gautier to speak of it as the Hercynian chain. Along the Wed Saura the folds run regularly north-west and south-east, but in the Gurara region the direction varies. There are also frequent horizontal strata, the age of which is difficult to determine, but which seem in part at least to be Cretaceous. They are important from their water-bearing character, and it is their contact with the Devonian rocks which determines the distribution of vegetation and human life. Even along the Saura and the Sebka of Gurara the water-supply is not derived, as might be supposed, from the wed and Sebka themselves, but owes its existence to the erosion of the depressions, which has cut down the superficial strata to the level of the impermeable Devonian. It is obtained, not from wells, but from springs, which the people utilize by the construction of underground conduits, or "fgagira." This explains the fact that all the oases lie on the east side of the two depressions. A broad natural distinction can thus be drawn between the three subdivisions of the French Sahara. At the two extremities (Wargla and Gurara) there is a fairly abundant water-supply, but whereas it is artesian in character at Wargla, owing to the plunging of the water-bearing strata, at Gurara it is brought to the surface by the outcrop of the impervious Devonian rocks. The central region, or Algerian Sahara proper, has no such advantages, though, strange to say, it is that on which, in the blind effort for expansion, French effort has been principally directed. The writer, while allowing that Gurara possesses only limited

resources, and is at a disadvantage as compared with Wargla, does not consider the fear that it will become depopulated as likely to be realized. The shortness of the labour-supply, however, stands in the way of its development. M. Gautier carried out observations for longitude which seem to show that all the positions require to be shifted considerably to the east. It should be mentioned that during the present year he has made an interesting trip to the Muidir plateau, of which we hope to say more later.

Economic Provinces of the Sahara.—In a dissertation for the degree of Doctor at Jena University, printed last year at Wolfenbüttel, Herr Dürkof endeavours to subdivide the Sahara into provinces on the basis of principal vegetable products either exploited by the natives or exported to foreign markets. He starts from the definition of the desert, not as a region with such-and-such minimum of rainfall (the important factor being not so much the actual amount of this as its distribution through the year), nor as one from which there is no surface drainage, but as a region in which the scarcity of rain, and, as a consequence, of vegetation, renders it unsuited for the abode of man, either continuously or for short periods, by reason of the absence of the necessary vegetable food for himself and his flocks. He therefore regards as forming a separate category such tracts as afford more or less pasturage, classing these as "Wüstenweide." He does not, however, press this distinction to its logical issue, for among the economic products of the desert, a large proportion are such as supply articles of food, and are in fact produced rather in the oases and bordering steppe regions than in the desert proper. By excluding from consideration the various fodder-plants, he likewise omits one of the most important factors in the domestic economy of the Saharan peoples. After a very brief consideration of the conditions of rainfall and plant-growth in the Sahara, in the course of which he points out that it is the ground-water rather than the actual rainfall which determines the distribution of vegetation, the author proceeds to describe the nine different provinces which he defines on the basis of their economic vegetable products. The most extensive and important are those of gum arabic, alfa, and the date palm, each of which is again divided into sub-provinces. Gum arabic is produced, *e.g.*, chiefly in Northern Senegal, the steppes of the Nile basin, and in South-West Morocco, while the principal subdivisions of the date-palm province are—the Algerian Sahara, Fezzan, Tripoli, and the Nile valley and Libyan desert. Products of secondary importance which are taken as characterizing definite provinces are senna (in Air) and colocinth and "Siwah" (Tibesti, Borku, etc.). As is natural, Herr Dürkop's provinces overlap to a considerable extent, for Tripoli, to take one instance only, falls both to the "Alfa" province and to that of the date-palm. Yet the author has to some extent adopted a purely topographical basis, three of the provinces laid down being not especially marked by the presence of any one characteristic plant, but seem to be defined merely to complete the consideration of the whole area. These, as well as the main provinces, produce various plants of minor economic importance, some, like *Hyphæne thebaica*, *Balanites ægyptiaca*, *Zizyphus jujuba*, and others, supplying both wood and fruit, while many others supply accessory articles of food in times of need.

AMERICA.

Geology of the Sierra Madre of Mexico.—In a reprint, recently received, from the *Transactions* of the American Institute of Mining Engineers, Mr. W. H. Weed describes the geology of the Sierra Madre region as studied by him during a journey across the highlands from Parral to the Gulf of California *viâ* Guadalupe y Calvo. In Chihuahua at least the Sierra Madre is a great plateau rather than a mountain range, though it is trenched by deep cañons in its centre, and dissected into a rugged complex of mountains along its western borders. In the east its

elevation is about 7000 feet, while near the continental divide it reaches a height of 10,500 feet, gradually falling to about 6800 feet in the west, where the plateau breaks up into the bordering mass of mountains. It is built up of successive flows of eruptive lavas, principally dacites and rhyolites, the results of great outbursts such as formed the great rhyolitic fields of the western United States. On the east these rocks rest upon folded slates, but in the west the underlying rocks are principally andesites, of direct volcanic origin, forming an irregular plateau comparable to the range east of the Yellowstone Park, and deeply dissected before the date of the rhyolite eruptions. The ore-deposits for which this part of Mexico is famous occur only where erosion has laid bare the andesite, the rhyolite flows having taken place at a time subsequent to their formation. The plateau is fringed by mountains on the east, the foothills being covered with scrubby oak bushes, while in the higher parts both oaks and pines of a fair size occur. On the rhyolite plateau further west water is relatively scarce, the few streams being shallow, and showing, in the dry season, merely isolated pools of water. Trees still occur on the low hills and bossy outcrops which diversify the surface, but the largest specimens are seen on a basalt-covered area beyond the cañons of the Nivarra and Riparra, which is described as an ideally beautiful timber country. Westward of this, the elevation decreases towards the cañon of the Rio Verde, the gorge of which is about 2000 feet deep, though only at its base are the cliffs vertical. The barometer showed 7300 feet at the river-crossing. Looking westward, the front of the plateau is seen as a black straight profile, having no resemblance to a mountain region, though it is commonly called the summit of the Sierra Madre. A little west of the deep basin in which Guadalupe y Calvo is placed the great plateau suddenly ends, and the sea of mountains formed by the erosion of its western border begins. Unlike the eastern mountain rim, which is narrow and elevated, this zone of perhaps 15 miles' width is generally lower than the plateau, and is made up of lateral spurs and ridges transverse to its border. Here cuts of 3000 to 5000 feet prevail, and the abrupt descent from the plateau summit is accompanied by a corresponding change in the vegetation. The Bazonopi, a large branch of the Sinaloa, cuts a horseshoe cañon some 60 miles long through the heart of the mountains, and displays the geological structure well, granite and diorite, as well as andesites, being here laid bare.

AUSTRALASIA AND PACIFIC ISLANDS.

Geological Investigations in the Gulf of Carpentaria.—A report on a visit to the west coast of the Cape York peninsula and some of the islands in the Gulf of Carpentaria, by Mr. C. F. V. Jackson, assistant Government geologist, has been issued by the Queensland Department of Mines as Geological Survey Report No. 180 (1902). The geology of this region has hitherto been imperfectly known, and Mr. Jackson's investigations, made during a voyage in company with Dr. Roth, the northern Protector of Aboriginals, will enable some corrections and additions to be made to the geological map of the state. The Upper Cretaceous "desert sandstone" formation extends southward through the peninsula, save for a small area of older quartzites, etc., for nearly 400 miles to the Mitchell river. In the north it forms the coast-line (the cliffs at Vrilya point being nearly 80 feet above sea-level), but further south its western escarpment recedes for some distance, the actual coast-lands consisting of low, timber-covered flats with frequent sand-dunes. Associated with the sandstone, which in its upper portion is ferruginous, there is a deposit of pisolitic ironstone, which seems to extend more or less continuously northward to the north point of the peninsula, and which Mr. Jackson considers may contain ores of some value. From the recently established Weipa mission station on the Embley river, a trip was made into the

interior, as far as the Moreton telegraph station, several large creeks not marked on our maps being discovered. The desert sandstone, which further south forms the barren mulga ridges and isolated flat-topped hills which characterize western Queensland, here presents a quite different aspect, owing to the large annual rainfall (55 inches). The country is well timbered with eucalyptus, tea-tree, etc., and the surface is luxuriantly grassed. In the vicinity of the Mitchell river (which enters the sea by several mouths) the coast is low and sandy, and apparently subject to inundation by the sea. Similar country extends right down to Normanton, the coast running in a long unbroken line devoid of prominent landmarks, and invisible from the deck of a vessel at a distance of 6 miles. It is fringed with mangroves, which by their seaward growth form a barrier, behind which are vast salt-pans and marshes. These mangroves exercise a most important influence on the physical history of the coast, the salt-marsh and salt-pan country extending along it as far as the western boundary of the state. A visit was paid to Sweer's island and Bentink island, between which lies Investigator Road, once proposed as the main port for the Gulf of Carpentaria, though the idea has long since been abandoned. Sweer's island is in part composed of a recent calcareous sandstone, formed of sand blown up by the wind and consolidated by the large proportion of calcareous and other cementing ingredients. It is well timbered in places, and fairly well grassed, and supports sheep and goats, the property of two or three men who reside on the island. It is now not visited by natives, whereas the neighbouring Bentink island is inhabited by a considerable number of blacks, who live in a most primitive style, their camps consisting merely of low barriers of grass for protection against the wind. Both here and at Sweer's island numbers of stone fish-traps were seen along the coast, but attempts to obtain a view of the natives were quite unsuccessful, though Dr. Roth had managed to do so during a former visit to the island.

The Queensland Weather Bureau.—We lately referred to the difficulties in which the Queensland Weather Bureau was placed owing to the refusal of the Federal authorities to supply the necessary funds for its upkeep. It was hoped, however, that, with the help of temporary grants by one or two of the states, the good work done by the bureau might be continued until some permanent arrangement could be made for the inauguration of a Government meteorological department for the Australian Commonwealth. Fresh difficulties have, however, arisen, and we regret to learn that Mr. Wragge, whose name has so long been associated with the work of the bureau, has been forced to sever his connection with it. The bureau will not be closed entirely, but has been taken over by Mr. Henderson, the hydraulic engineer. The work will, however, be much restricted in scope, being limited to the record of rainfall and other meteorological observations, the forecasts, which have hitherto been a special feature in the undertaking, being henceforth abandoned.

The Alleged Disaster to a French Expedition in New Guinea.—Early in 1902 a report was circulated that a disaster had occurred to a French Scientific Expedition in New Guinea, of which several members were said to have been murdered by the natives of the south coast, near the British and Dutch boundary. Circumstantial details were supplied, and went the round of many of the geographical publications on the continent, a reference being made to the supposed facts in our own *Journal* for June, 1902. It now appears that the whole story was purely a newspaper fabrication, no such expedition having even visited New Guinea. Inquiry was made by the British authorities at Port Moresby of the Dutch "Controleur" at Merauke, the district in which the alleged massacre was supposed to have taken place, and we are informed by the Government secretary at Port Moresby that the result has been to show that the whole story was entirely untrue.

Visit to Dutch New Guinea.—A few details concerning the Humboldt and Tanah Merah bays, from the report of the officer in command of the Dutch man-of-war *Ceram*, are published in the *Bijdragen tot de Taal- Land- en Volkenkunde van Nederlandsch Indië*, 1903, Nos. 1 and 2. The Humboldt bay is begirt on all sides by steep-flanked mountains, except on the south-east, where lies the flat country of Sko, from which rises the low range of the Bouganville mountains. The inner—Yautefa—bay is separated from the outer bay by a narrow, low, and sandy landspit planted with oil palms. The appearance of the bay shows that agriculture cannot be the chief occupation of the natives, and the chief villages, Taubadi and Engeros, are situated opposite one another just within the Yautefa bay, and are built over the water. The houses are of pyramidal form, and are bordered by galleries from which the inhabitants can descend into their canoes. The most conspicuous building is the karewari, or rum-seram, a temple in which religious rites of some kind or other are performed. The men of Nafri, on the south-east coast of the bay, are clearly of a different type, and have a more attractive appearance. The houses being all connected with the shore, the life is somewhat different and the language is not the same as in the other villages. The type in the Sko country is in many respects similar to the Yautefa, but the men are less forbidding. Whereas the Yautefa men wear no covering, the Sko men always wear a hollowed gourd, like all the other natives east of Humboldt bay. South of the Cyclops mountain lies the Sentani lake, a sheet of water of very fantastic outline, and sinking to a maximum of about 150 feet. The people speak a language closely allied to that of Nafri, and have much in common with the inhabitants of that village. Whereas, however, the latter go little upon the water, the Sentani people are exceedingly skilful with the paddle. They catch fish in the lake, and keep pigs. Several villages stand on the coast along the foot of the Cyclops mountain, one of which, Orum, is noted for its axe stones, obtained from a quarry in the mountains. The natives of Tana Mera bay are quiet and peaceful, and seem to be more civilized than those of Yautefa. They live more by agriculture than by fishing. They have no rum-seram, and no religious forms have been observed among them. With the inhabitants of the adjoining mountains they live on good terms, bartering fish for their sago; but with the Manemboal, further inland, they do not agree so well. Much information is given in the report on the manners of the natives, their weapons and implements, their ornaments and tattooing, etc. Several illustrations and a map accompany the article.

Journey from Geelvink Bay to McCluer Gulf.—In 1901 the controleur, P. E. Moolenburgh, crossed New Guinea where it narrows down between Geelvink and McCluer gulf. His narrative, printed in the *Tijdschrift van het K. Nederl. Aardrijksk. Genootschaf*, No. 2, is more easy to follow with the help of the map in No. 3, compiled under the direction of Mr. J. F. Niermeyer. From Karwan on Geelvink bay Mr. Moolenburgh crossed a range 1600 feet high or more, and descended on the other side over very rough ground, reaching, at 4 p.m., Woroboï, on a tributary of the Yakati river. He then descended in a boat to the Yakati and up the Sollong to Manggoï on the Yense or Inse, and, returning to the Yakati, visited the village Inse on the estuary of the united Yakati and Inse on Modan island. On the return journey he ascended the Yakati for some distance further, to a place called Sainuri, and reached the coast to the east by an easy route terminating on Geelvink bay at Adimawau, some distance north of Karwan, having spent seven days on the whole journey. Steamboats of small draught could probably ascend at high water to Sainuri. The woods on the banks consist of sago and dammar bushes, and wild nutmeg of inferior quality, but yielding excellent timber. The fauna is poor; birds of Paradise and rhinoceros birds, marsupial rats,

pigs, and kangaroos were observed. Coral formation occurs at the highest points. Mr. Niermeyer remarks that it is now established that the Yakati is not a mere salt-water creek, but a river, though perhaps not the only drainage channel of the country. His map is compiled from a recent rough marine survey of the Gulf of Bintuni (eastern part of McCluer gulf), the survey of the *Gazelle*, the map of Hondius van Herwerden, and that of Dr. A. B. Meyer, who in June, 1873, crossed the isthmus. On the whole, they agree fairly with Herr Moolenburgh's map, but it is singular that the places on the Yakati recognized on Meyer's map lie on the part of the river running north and south, whereas both in the map and text Meyer makes the river run east and west. If, however, his map be turned through a right angle, the upper river runs, as Moolenburgh states, from the hilly country to the west.

POLAR REGIONS.

Arctic Expeditions.—Commander Peary continues to show an indomitable perseverance in his endeavours to achieve the conquest of the north pole. He has obtained three years' leave from the Navy Department, and hopes to start once more for the north at the beginning of next July. He will employ a new steamer, and proposes to establish a permanent base at Cape Sabine, pushing his way thence to Grant Land and there taking up winter quarters, the final start for the pole being made in the February following. His plan is to use dog-sledges with light loads for the advance party, which will be supported by a larger, more fully equipped party. As on his last great expedition, he will receive the support of the Peary Arctic Club, but his work will also have the recognition of the American Government. It is announced, also, that Captain Bernier, whose plans for an expedition under the auspices of the Canadian Government have been previously alluded to in the *Journal*, has at last completed his arrangements, and will start for the north next year. Meanwhile, the Canadian Government steamer *Neptune* has sailed (in August of the present year) for Hudson bay and other Arctic waters, for the purpose of botanical, geological, and zoological research on behalf of the Canadian Government. Special attention will be devoted to the question of the cod and halibut fisheries, and with a view to their protection a police-station will be established at Chesterfield inlet. Formal possession will also be taken of the northern islands and the coasts of Baffin bay.

The Antarctic Relief Expeditions.—The work of refitting the *Terra Nova* for the voyage in relief of the *Discovery* was pushed forward with such energy that the ship was able to start from Portland on August 26. As far as Gibraltar she was towed by H.M.S. *Minerva*, and from Gibraltar to Aden by H.M.S. *Vindictive*, the latter port being reached on September 14. From Aden the ship proceeded direct to Hobart, where she will be joined by the *Morning*, it being hoped that the two ships may make the final start south by the beginning of December. The reasons for the selection of Hobart as the ultimate base are not quite apparent, as it involves not only the voyage of the *Morning* from Lyttleton to that port, but a greatly lengthened voyage for the two ships after their junction is effected. It should be mentioned that Captain Colbeck left this country some ten days before the departure of the *Terra Nova* in order to resume command of the *Morning*. The Swedish expedition for the relief of Dr. O. Nordenskiöld sailed from Stockholm, in the *Frithjof*, on August 17, under the command of Captain Gylden.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria. *M.K.K.G. Ges. Wien* **46** (1903): 167–172. **Lorenz v. Liburnau.**

Nachträgliches über das Gmundener Schotterterrain. Von Dr. J. Ritter Lorenz v. Liburnau.

Austria. *M.K.K.G. Ges. Wien* **46** (1903): 173–189. ——

Bericht über die Leistungen des K. u. K. Militär-Geographischen Institutes im Jahre 1902.

Austria—Dalmatia. *B.S.G. Italiana* **4** (1903): 303–328. **Dainelli.**

Di alcuni rumori naturali che si odono presso Otres (Bribir) in Dalmazia. Nota del dott. G. Dainelli.

Austria—Istria. *Vierteljahrshefte G. Unterricht* **2** (1903): 235–238. **Krebs.**

Wanderungen aus Istrien. II. West- und Mittelistrien. Von Dr. N. Krebs.

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See note in August *Journal* (p. 211). The present note describes two other fossils found in Damerghu, one being the first ammonite brought from the Sudan.

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Allgemeiner Bericht über den Verlauf der Deutschen Südpolar-Expedition, von Erich v. Drygalski. Mit Vorbemerkungen von Ferdinand Freiherr v. Richthofen und einem Anhang: Bericht über die Arbeiten der Kerguelen-Station von Karl Luyken. Berlin: E. S. Mittler und Sohn, 1903. Size 10½ × 7, pp. viii. and 54. *Presented by the Publishers.*

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Notes sur des expériences faites au Congo français et sur une installation de postes aux Antilles. Par M. Magne. *With Map and Illustrations.*

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Henri le Navigateur et l'Académie Portugaise de Sagres. Pelo dr. J. Mees.

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See note in the Monthly Record (*ante*, p. 456).

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La localisation des industries, particulièrement aux États-Unis. Par H. Hauser.

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Un Explorateur Polaire Français, Lucien Bellot. Par A. Breittmayer.

Commerson. **Moewes.**

Naturw. Wochenschrift **2** (1903): 340–342, 349–355, 389–392, 400–403.

Philibert Commerson, der Naturforscher der Expedition Bougainvilles. Von Dr. F. Moewes.

Scherzer. *M.K.K.G. Ges. Wien* **46** (1903): 161–166. **Krupitz.**

Dr. Karl Ritter von Scherzer. Von Karl Krupitz.

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La Geografia nel Congresso Internazionale di Scienze Storiche. Nota del R. Almagià e C. W. Guastalla.

Mountaineering. *Appalachia* **10** (1903): 166–172. **Larrabee.**

Observations on the Physiology and Hygiene of Climbing. By R. C. Larrabee.

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[Japanese Trans-literation of Place-names.] Size 9 × 6, pp. 46.

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The All Red Line. The Annals and Aims of the Pacific Cable Project. Edited by George Johnson. London: E. Stanford; Ottawa: J. Hope & Sons, 1903. Size 7½ × 5, pp. 486. *Map. Price* 6*s*. *Presented by Mr. Edward Stanford.*

Although in parts written in somewhat high-flown language, this work is useful as an attempt "to present the annals of the Pacific cable project in a concise and consecutive form." Various writers have contributed chapters on special parts of the story.

Year-Book. **Wagner.**

Geographisches Jahrbuch. XXV. Band, 1902. . . . herausgegeben von H. Wagner. Gotha: Justus Perthes, 1903. Size 9 × 6, pp. viii. and 488. *Price* 15*m*.

In addition to bibliographical reports on the regional geography of extra-European lands, this volume deals with recent publications on structural geology, geophysics, and surveying.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Balkan Peninsula. **Steinhauser and Peucker.**

Á Steinhauser's Karte von Südost-Europa. Scale 1:2,000,000 or 31·5 stat. miles to an inch. Die Staaten der Balkan-Halbinsel sammt Theilen von Oesterreich-Ungarn bis Budapest und Wien und den übrigen angrenzenden Ländern. Mit neuester politischer Eintheilung und statistischen Angaben von Dr. K. Peucker.

Uebersichtskarte der Balkanstaaten. Scale 1:3,000,000 or 47·3 stat. miles to an inch. Aus Scheda-Steinhausers Handatlas. Revidiert von Dr. Karl Peucker. Vienna: Artaria & Co., 1903. *Presented by the Publishers.*

Two small general maps of the Balkan Peninsula and portions of adjacent countries, revised by Dr. Karl Peucker, of Vienna. The one on the larger scale (1:2,000,000) is

a new edition of A. Steinhauser's map, and the smaller (1 : 3,000,000) is from Scheda-Steinhauser's Handatlas. Statistical information is given in connection with areas, population, etc. The maps are printed in colours, and, although roughly produced, will be useful for general reference in connection with the present interest in this part of Europe.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1903.

1 inch:—

Printed in colours, 117, 133, 134 and part 118 (combined), 103, 104 (combined), 1*s.* 6*d. each*; 75, 79, 1*s. each*.
(Second revision) in outline, 299, 318, 330. 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Cambridgeshire, 4 N.E., 5 N.E., 27 N.E., 36 N.E., S.E., 42 N.E., S.E., 43 S.W., 53 S.E., 54 N.W., N.E., 55 N.E. **Cardiganshire,** 2 S.E. **Dorsetshire,** 6 N.W., N.E., S.E., 11 N.E., 12 N.W., N.E., S.W., S.E. **Gloucestershire,** 17 S.W., S.E., 18 N.W., N.E., S.W., 26 N.W., 36 S.W., S.E., 41 N.W., N.E., S.W., 42 S.W., 43 S.W., 46 N.W., 48 S.E., 50 S.W., 54 N.W., 55 N.W., 56 N.E., 59 N.W., 60 N.E., 62 N.E., 64 S.E., 68 S.E., 78 N.W. **Leicestershire,** 10 S.W., 16 N.E. **Montgomeryshire,** 32 S.E., 37 S.E., 38 S.W., 43 N.E., 44 N.W., S.W., 45 N.W., N.E., 47 S.E., 48 N.W., 49 N.W., 51 S.E., 52 N.W. **Radnorshire,** 2 S.W., 3*a* S.E., 4 N.W., 7 S.E., 8 N.W. **Shropshire,** 31 S.E., 34 N.W., 38 S.W., 48 S.E., 49 S.W., S.E., 50 S.W., 53 S.E., 54 S.W., 55 N.E., S.W., S.E., 56 N.W., N.E., 57 N.W., S.E., S.W., 58 S.W., 59 S.W., 61 S.W., 62 N.W., N.E., S.W., 63 N.W., N.E., S.W., 64 N.W., N.E., S.W., S.E., 65 N.W., N.E., S.W., S.E., 66 N.W., S.W., S.E., 67 N.W., S.E., 68 N.E., 69 N.W., 71 N.E., 72 N.W., N.E. **Somersetshire,** 84 N.W., N.E., S.E. **Staffordshire,** 35 S.E., 43 N.W., 49 S.E., 62 S.E., 63 N.W., 64 N.W., N.E., 65 N.W., 67 N.W., 74 N.E. **Warwickshire,** 4 N.W., N.E., 5 N.W. **Wiltshire,** 5 N.E. **Worcestershire,** 8 N.E., 9 S.E., S.W., 14 N.E., S.E., 15 N.W., S.E., 59 S.E., 60 N.W., N.E. **Yorkshire** (first revision of 1890 survey), 284 N.W., 287 S.W., 290 N.E., 291 N.E., 300 S.W.

25-inch—County Maps (first revision):—

Cambridgeshire, LVII. 14; LIX. 5, 9, 10, 12, 13, 14; LXIIA. 8; **Dorsetshire,** VA. 16; V. 6; XI. 2; XIX. 7, 11, 13, 14, 15; XX. 5, 12, XXXVI. 4; XXXVII. 59. **Gloucestershire,** XXIII. 8, 11, 13, 14, 15; XXIV. 6, 9, 10; LIII. 2, 6, 7, 10; LXV. 2, 4; LXVII. 8; LXVIII. 9, 13; LXIX. 1, 5, 13; LXXII. 1, 6; LXXVII. 2, 4. **Herefordshire,** II. 2. **Leicestershire,** XI. 10, 11, 12; XII. 3, 7, 9; XXIII. 8, 12; XXIV. 14; XXIX. 3, 8, 10, 14; XXX. 1; XXXVI. 11, 15; XLIII. 6, 7, 10, 11. **Radnorshire,** IV. 15; VIII. 9, 10, 11, 12; IX. 1; XV. 2, 3, 5, 6, 7, 8, 9, 10, 12; XVI. 6, 7, 9, 11; XVIII. 11. **Shropshire,** LXXI. 16; LXXII. 15, 16; LXXIII. 14, 15, 16; LXXVII. 2; LXXVIII. 7, 8; LXXX. 1, 2. **Somersetshire,** V. 3, 4, 5; IX. 4, 8, 16; X. 2, 3, 4, 5, 6, 9, 11, 14; XI. 5; XII. 6, 9, 10, 12; XVI. 4, 6; XVII. 1, 2, 3, 5, 6, 11, 12; XVIII. 12, 15; XXIII. 14, 15; XXVIII. 5; XXXIV. 4, 7, 10, 11; XXXIV. 12, 13, 14, 15, 16; XLV. 4, 7, 12, 16; XLVI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 13, 14; LXIII. 4, 7, 8, 16; LXIV. 1, 6, 9, 10, 13, 14; LXXII. 8; LXXIII. 3; LXXIV. 12, 15, 16; LXXV. 10; LXXXI. 16; LXXXII. 5, 6, 9, 10; LXXXIII. 1, 2, 6, 9, 13; LXXXVIII. 1, 8, 16; LXXXIX. 13; XC. 2; XCI. 4; XCII. 5, 7, 11, 14, 15; XCIII. 1, 5. **Staffordshire,** LXI. 10, 15; LXIII. 15; LXVI. 2; LXVII. 13; LXXI. 12, 13. **Suffolk,** LXXXIX. 12, 16. **Warwickshire,** X. 1, 2, 5, 11; V. (*sic*) 12; **Worcestershire,** IV. 12, 13; XIII. 13, 15; XIX. 4, 15; XX. 5, 6, 8, 11; XXII. 13, 14. **Yorkshire,** CCLXXXVII. 8, 11, 15, 16. 3*s. each*.

2 miles to 1 inch—Miscellaneous Maps:—

Salisbury Plain (parts of sheets 78, 79, 86, 87), 1*s.*, mounted on linen and folded in cover.

Manœuvre Map, 1903, South of England, north, south, east, west, 6*s.*, on thin tough paper, folded in cloth case, in four sheets.

(*E. Stanford, London Agent.*)

England and Wales.

1 inch scale (Old series).

Sheet 45 N.E. (Drift edition). 3*s.*

(*E. Stanford, London Agent.*)

Norfolk Broads. **Darbishire and Stanford.**

Map of the Norfolk Broads and Rivers. Scale 1 : 3,1680 or 2 inches to 1 stat. mile. 2 sheets. Oxford: Darbishire & Stanford, 1903. *Price* 1*s. each sheet. Presented by William Stanford, Esq.*

These two sheets extend from Stalham on the north to Beccles on the south, and from the coast to Coltishall on the west. Water is coloured blue, and roads and railways are clearly shown.

Thames. **Stanford.**

The Molesey River. Map of the Thames from Laleham to Kingston, by William Stanford. Scale 1 : 31,680 or 2 inches to 1 stat. mile. Oxford: Darbishire & Stanford, 1903. *Price* 1*s. Presented by William Stanford, Esq.*

Numerous notes, giving information concerning locks, distances, bridges, hotels, and other matter likely to be of interest to tourists, are given upon these maps, and add considerably to their general utility. The maps belong to a series, which is in course of publication for the use of tourists and others.

United Kingdom. **Geological Survey.**

General Memoirs. Summary of Progress of the Geological Survey, 1902. 1*s.*
Cretaceous Rocks of Britain, vol. ii. The Lower and Middle Chalk of England. 10*s.*

ASIA.

Asiatic Russia. **Russian Government.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1 : 1,168,031 or 18·4 stat. miles to an inch. Sheet 28. St. Petersburg: Military Topographical Department. [**In Russian.**]

Approximately, this sheet includes the area between 29° 20′ and 36° N. lat. and 76° and 86° E. long., and it thus contains part of the N.-W. Provinces of India, Nepal, and the adjacent region of western Tibet. With regard to the latter, Captain Deasy's survey work has been utilized in the compilation, and throughout the sheet it is evident that care has been taken to take advantage of the best available cartographical material, which, however, in many districts, is still very vague and incomplete.

AMERICA.

Alaska Boundary. **Alaska Boundary Commission.**

British Case, Alaska Boundary. Atlas of maps, appendix, vol. ii. Portfolio of maps accompanying International Boundary Commission Report of December 31, 1895. Appendix, vol. iii. *Presented by the British Agent, the Hon. Clifford Sifton.*

These maps will be specially noticed in the *Geographical Journal.*

United States. **U.S. Geological Survey**

Geological Atlas of the United States. Scale 1 : 125,000 or 1·8 stat. mile to an inch. Folios: 72, Charleston; 73, Coos Bay; 74, Coalgate; 75, Maynardville; 76, Austin; 77, Raleigh; 78, Rome; 79, Atoka; 80, Norfolk; 81, Chicago; 82, Masontown-Uniontown; 83, New York City; 84, Ditney; 85, Oebrichs; 86, Ellensburg; 87, Camp Clarke; 88, Scotts Bluff; 89, Port Orford; 90, Cranberry. Department of the Interior, United States Geological Survey, Washington, D.C., 1901–1903. *Presented by the U.S. Geological Survey.*

GENERAL.

World. **Dulcert.**

La mappemonde d'Angelino Dulcert, de Majorque (1339). Avec texte par le Dr. E. T. Hamy. 2nd edition. Paris: Honoré Champion, 1903.

This is a facsimile, by photographic process, of the interesting map of the world by Angelino Dulcert, drawn in Majorca in 1339, and which was brought to light some few years ago by M. Lesouef. The name of the author, apart from this map, is unknown in the history of geography, and it has been supposed by Magnaghi and others to be but another rendering of Angelino Dalorto, the Italian cartographer, whose map of 1325 recently created considerable interest, and in many respects there exists a great similarity between the two maps, both of which bear a strong general resemblance to the Pizzigani map and others of the fourteenth century. However, Dr. E. T. Hamy, according to his note which accompanies this facsimile, is evidently not of this opinion, and concludes that the map is of Catalan origin, and that it is another proof that the Catalan cosmographers at this period had nothing to learn from the Italians.

Certainly the name Angelino Dulcert appears clearly as that of the author in the upper right-hand corner, together with the date. The map represents with considerable accuracy the coast-line of the Mediterranean in the centre, with the surrounding coasts of north-west Europe, including the British Isles and southern part of Sweden and Norway, the north-western and north-eastern coasts of Africa, the Red sea, Persian gulf, part of the western coast of India, the Black sea, and south-west Asia. Although evidently primarily intended for navigation purposes, the information the map contains is not altogether confined to the coast-line, and the author clearly intended to represent upon it all that was then known of the geographical features of the Earth, and, as was the custom at the period, has filled in blank spaces with figures, flags, symbolical representations, and copious notes. The reproduction is of the size of the original, which is now in the possession of M. Lesouef, and measures 3·41 × 2·46 feet.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stieler's Hand-Atlas, 100 Karten in Kupferstich. 19 und 20 Lieferung. Gotha: Justus Perthes. *Price 60pf. each part.*

These two parts are in one cover, and consist of maps Nos. 27 and 28, the two northern sheets of a four-sheet map of France; and Nos. 34 and 35, the two southern sheets of a four-sheet map of Spain and Portugal. These are on the scale of 1 : 1,500,000, and are new editions.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May and June, 1903. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3339 m	= 1·5	Ireland, west coast:—Approaches to Galway bay. 2*s.* 6*d.*
3335 m	= 0·3	Labrador and Newfoundland:—Approach to strait of Belle Isle (reproduction). 2*s.* 6*d.*
3348 m	= 11·2	West Indies, Culebra, south coast:—Great harbour. 2*s.* 6*d.*
3326 m	= 0·26	South America, east coast:—Bom Ambrigo island to Arvoredo I. 2*s.* 6*d.*
3333 m	= 1·91	British Columbia, Johnstone strait, sheet II. (central). 2*s.* 6*d.*
3350 m	= 0·4	China, Yang-tse Kiang:—Sketch of the Poyange lakes. 2*s.* 6*d.*
3341 m	= 0·16	Gulf of Tartary:—Southern sheet. 2*s.* 6*d.*
3340 m	= 0·16	Gulf of Tartary:—Northern sheet. 2*s.* 6*d.*
309 m	= 3·0	Australia, south coast:—Port Philip, west channel (reproduction). 1*s.* 6*d.*
2521 m	= 8·0	New Zealand:—Tauranga. 2*s.* 6*d.*
3343 m	= 1·72	New Zealand:—Gable end foreland to Poverty bay. 2*s.* 6*d.*
193		Plans in the Mediterranean. New plan:—Linosa island.
1313		Chile. The channels between Port de Ancud and Port Montt. New plan:—Port Montt.
2316		Plans on the coast of Chile. New plan:—Coloso cove.
648		Africa, east coast. Delagoa bay to river Zambesi. Plan added:—Port Bartholomew Diaz.
14		Harbours and anchorages in the Red sea. Plans added:—Akik Seghir. Eid road.
751		India, west coast, sheet XIII. Plan added:—Kolachel anchorage.
2193		Sketch plan of anchorages between Mindanao and Celebes. Plans added:—Arangkaä anchorage, Ngalipaeng bay, Sawan and Ulu roads, Dago bay, Karaton anchorage. New plan:—Petta anchorage.
998		Malay peninsula. Pulo Kapas to Lakon roads. Plan added:—Entrance to Kalantan river.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2015	Isles of Arran.	New chart. Approaches to Galway bay	3339
2747A	Entrance to Port Phillip, including banks and channel.	New chart. Port Phillip, west channel	309
2521	Tauranga harbour Upper part of Tauranga harbour.	New plan. Tauranga harbour.	2521
1663	Poverty bay. Gisborne.	New chart. Gable end foreland to Poverty bay . .	3343

Charts that have received Important Corrections.

No. 1188, The world:—Coal and telegraph chart. 2585, England:—Coastguard stations. 2586, Scotland:—Coastguard stations. 2587, Ireland:—Coastguard stations. 2307, Norway, sheet V.:—Smölen to Sves fiord. 2246, Baltic sea:—Port Baltic to Hogland. 173, Baltic sea:—Approaches to Helsingfors and Sveaborg. 2247, Baltic sea:—Hogland to Seskär, north shore. 2826, Baltic sea:—Approaches to Viborg. 2215, Baltic, Gulf of Finland:—Kronstadt, north and south channels. 2372, Baltic sea:—Libau to Lyserört. 2371, Baltic sea:—Memel to Libau. 1436, Mediterranean, Ægean sea:—Plans of anchorages in the Morea. 1661, Mediterranean, Ægean sea:—Port Mudros. 1569, Africa, north coast:—Approaches to Bizerta. 2282, Arctic ocean and Greenland sea:—565, Iceland:—Western portion. 566, Iceland:—Eastern portion. 2818, United States, east coasts:—Hampton roads and Elizabeth river. 1452, Bahamas:—Nassau harbour. 3316, West Indies, Leeward islands. Puerto Rico island:—Guayanilla harbour. 523, Gulf of Mexico:—Port of Vera Cruz. 2544, South America, east coast:—Monte Video to Buenos Aires. 21, South America, Magellan strait:—Second narrows to Cape Pillar. 660, Central America:—Corinto harbour. 2462, Alaska:—Windham Bay to Icy Cape. 1500, Alaska:—Kadiah island to Seguam island. 759A, Madagascar:—Cape St. Andrew to Bevato island. 758, Madagascar:—Northern portion. 66 A, B, C, India, west coast:—Maldive islands. 859, Bay of Bengal:—Mutlah river to Elephant point. 942A, Eastern archipelago, eastern portion. 2575, Celebes sea, eastern part. 1961, China:—Pescadores islands. 1601, China, north-east coast:—Wusung river. 2432, Russian Tartary:—Tumen Ula to Strelok bay. 2650, Russian Tartary:—Strait of Tartary. 2185, New Zealand:—Nelson anchorages. 988, Pacific ocean:—Atolls in the Marshall group.

(*J. D. Potter, Agent.*)

PHOTOGRAPHS.

Persia. **Rigby.**

Fifty-three photographs of Persia, taken by Captain G. C. Rigby, 1st Wilts. Regiment, in 1903. *Presented by Captain G. C. Rigby.*

Many of these photographs are extremely interesting, especially those of Persepolis, and other ruins and antiquities, although from a purely geographical point of view those representing scenery, typical villages, etc., are, perhaps, more important.

(1) Panorama of Persepolis; (2) Looking down valley from Paichenar; (3) Ruin at Passargadae; (4) Bridge over Araxes; (5 and 40) Tomb of Cyrus; (6) Tomb of Hafiz, Shiraz; (7) The gap through which route from the north approaches Shiraz; (8) Market, Isfahan; (9 and 16) Lower bridge, Isfahan; (10) Tomb of Saadi, Shiraz; (11) Caravanserai, Manzaria; (12) Caravanserai, Mader-i-shah, built by the mother of Shah Abbas; (13) Madresseh-i-shah, Isfahan (exterior); (14) Madresseh-i-shah (interior); (15) Old palace, Isfahan, Ali Kapi, sacred gate; (17) Madresseh-i-shah, gate from inside; (18) Bridge, Isfahan; (19) Mosque, Isfahan; (20) Audience hall in palace, Isfahan; (21 and 26) Yezdikhast; (22) Old robber stronghold built on isolated rock, Yezdikhast; (23) Village of Maksud Beggi; (24 and 25) Maskat harbour; (27) Corner of Serai; (28 and 36) Kotal-i-Maller; (29) The last Kotal; (30) Fakir Abadeh; (31) Cliffs from south side of Dokhter pass; (32) On Pir-i-zan pass; (33) Bridge over Shapur river; (34) The end of Shiraz-Bushire route; (36) Wayside tea-shop, Pasangun; (37) Tarantas on top of Eburz range; (38) Corner of courtyard, Madresseh-i-shah, Isfahan; (39) Tomb of Darius; (41) Persian family, Puzeh; (42) Bund of Ali Verdi Khan, Khurud pass; (30) Garden at Shiraz; (44) Cliffs with names of ships, Maskat; (45) A Persian omnibus; (46) Persepolis; (47) On Khurud pass; (48) Bas-relief, Persepolis; (49) Gate of Kasvin; (50) Beggars at tomb of Saadi, Shiraz; (51) Grand staircase, Persepolis; (52) Bas-relief, Shahpur and suppliant emperor Valerian; (53) Tombs of kings, Puzeh.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given

34° 30'
LOULON
Uhu Kishla
Bey Aghil
Porsuk
Muradeh
Jeglakeau
Asar
Kartal Hassan Khan
Dubekjiathan
Porsuk Dermar
Hassun Ali
Fundukli
Umarlu
Horse Road
Caesarea
37° 30'
FAUSTINOPOLIS
Chifte
Chakut Su
Takhta Kupru
Graaur Sindikhi
Horoskeui
Ak Kupru
85 k. from Nigde
Ala Hodja
80 k. from Tarsus
Kizil Dagh
7000
Bulghar Maden
Top Dagh
PODANDOS
Bozanti

35°
34° 30'
35°
37° 30'
37° 30'
37° 30'
Dagh
00
OLOULON
Ilu Kiahia
Eregli
Bey Aghil
Porsak
Karaul Hassan Khan
Dubokji Khan
Demirdji Dermari
Muradeli
Jeglekeui
Asar
Omarli
Fenaklili
Kartal Hassan Khan
FAUSTINOPOLIS
Chakmak Su
Takkita Kupru
Horoskeui
Ak Kupru
80 k. from Tarsus
Kun. Nigde
Kizil Dagh
7000
Ata Hodja
Top Dagh
POGANDOS
Bozanti
CILICIA, TARSU
P

THE GEOGRAPHICAL JOURNAL 1903.

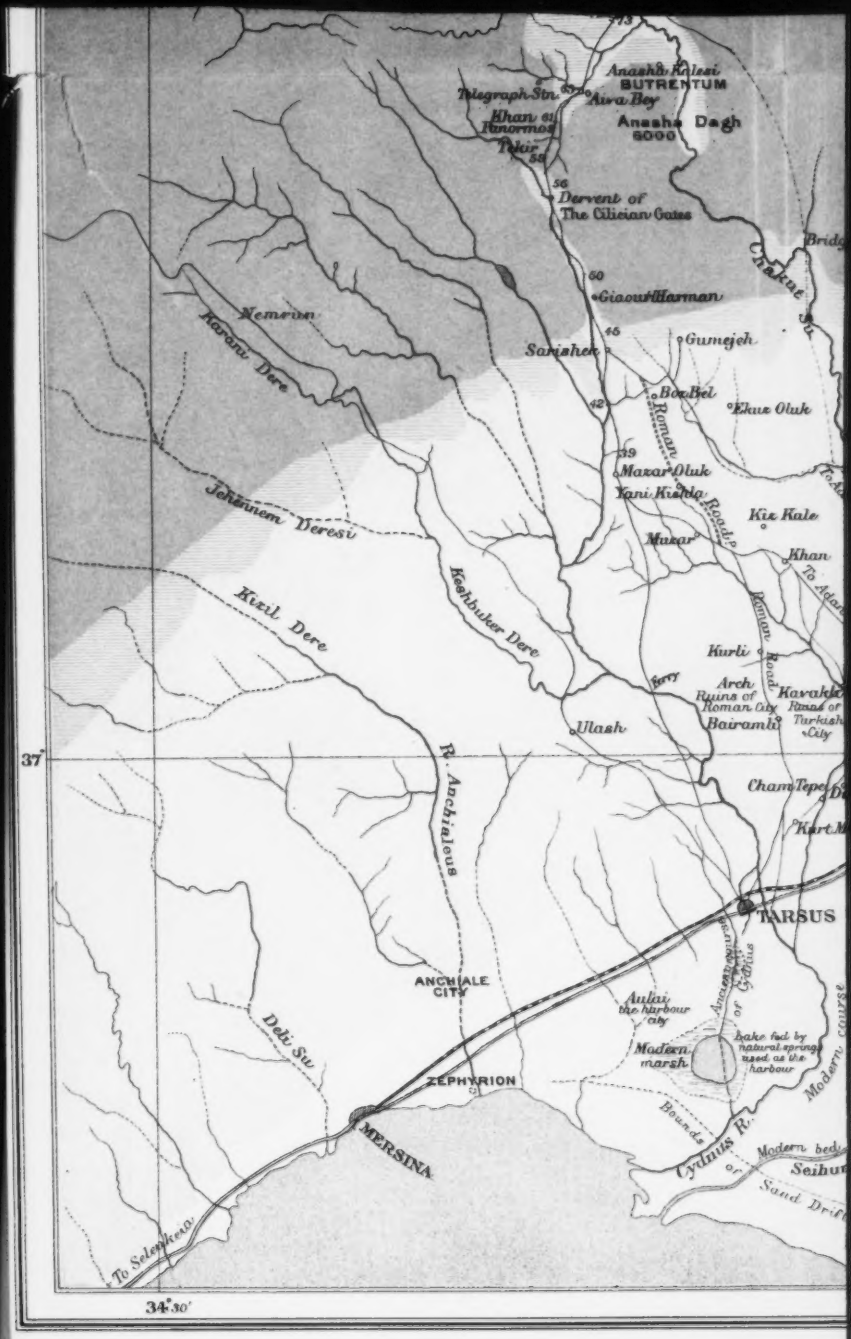
MAPS

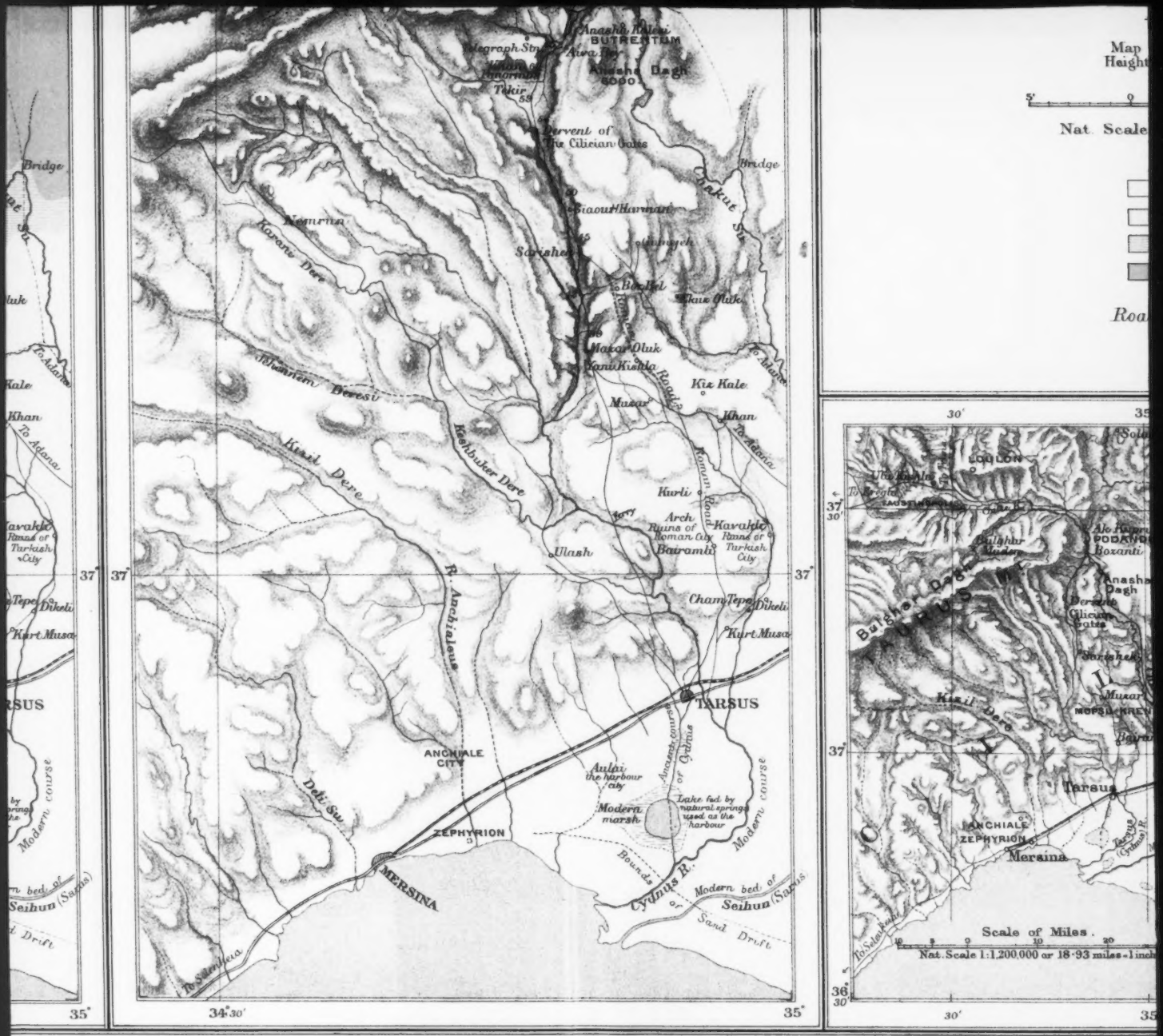
to illustrate the paper on

RSUS AND THE GREAT TAURUS PASS

BY

PROF. W. M. RAMSAY.


Anasha Kalesi
BUTRENTUM
Telegraph Stn.
Aiwa Bey
Khan
Tanormos
Pekir
Anasha Dagh
6000
Dervent of
The Cilician Gates
Bridg
Cydnus R.
Giaour Hamman
Nemrun
Karanu Dere
Sarishek
Gumejeh
Boz Bel
Ekuz Oluk
Roman
Mazar Oluk
Yani Kisla
Kiz Kale
Mazar
Khan
To Adan
Jehzinem Deresi
Kizil Dere
Keshbuker Dere
Roman Road
Kurli
Arch
Ruins of
Roman City
Kavakli
Ruins of
Turkish
City
Bairamli
Ulash
37°
R. Anchialous
Cham Tepe
Kurt M
TARSUS
ANCHIALE
CITY
Ancient course of Cydnus
Aulai
the harbour
city
Lake fed by
natural springs
used as the
harbour
Modern
marsh
Modern course
Delli Su
ZEPHYRION
Bounds
Cydnus R.
Modern bed
Seihun
or
Sand Drift
MERSINA
To Seleukeia
34°30'



Published by the Royal Geographical Society.

PROF. W. M. RAMSAY.

Map of the Pass adapted from Major Bennet.
Heights indicated roughly from eye impression.

Scale of Miles.

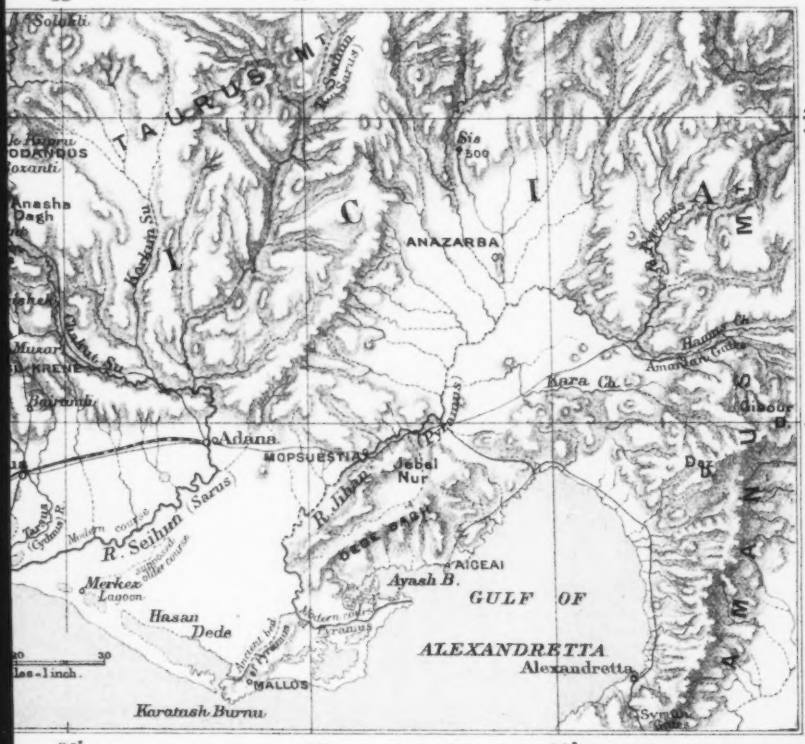
0 5 10 20

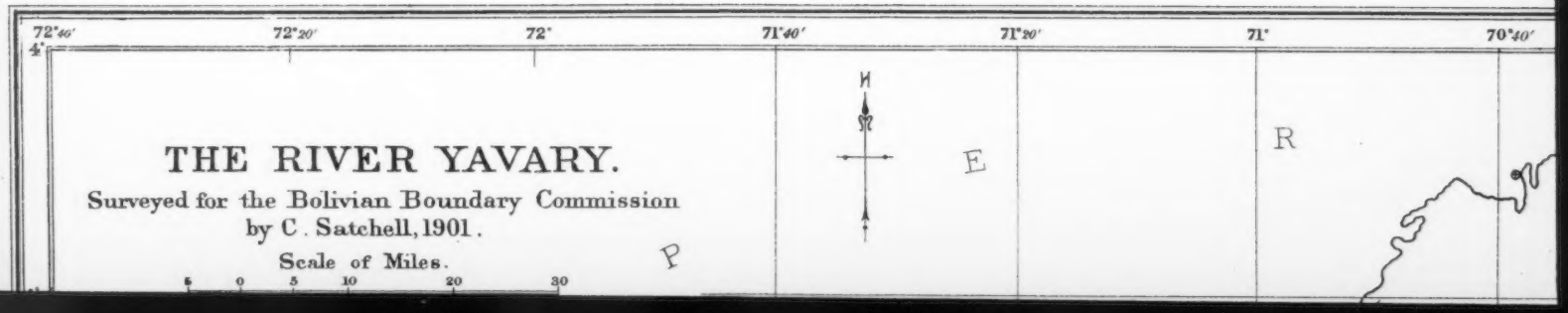
Scale 1:400,000 or 6·3 Stat. Miles = 1 Inch.

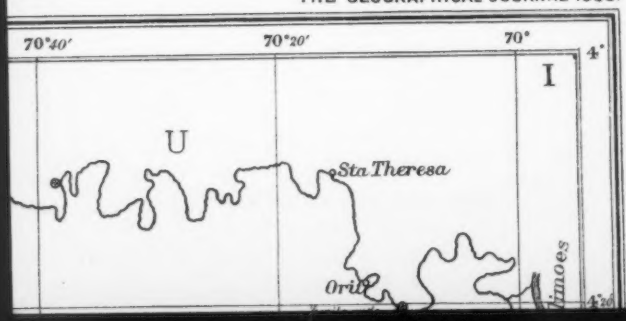
The sea plains of Cilicia
150 ft. to 3000 ft.
3000 „ 4000 „
above 4000 „

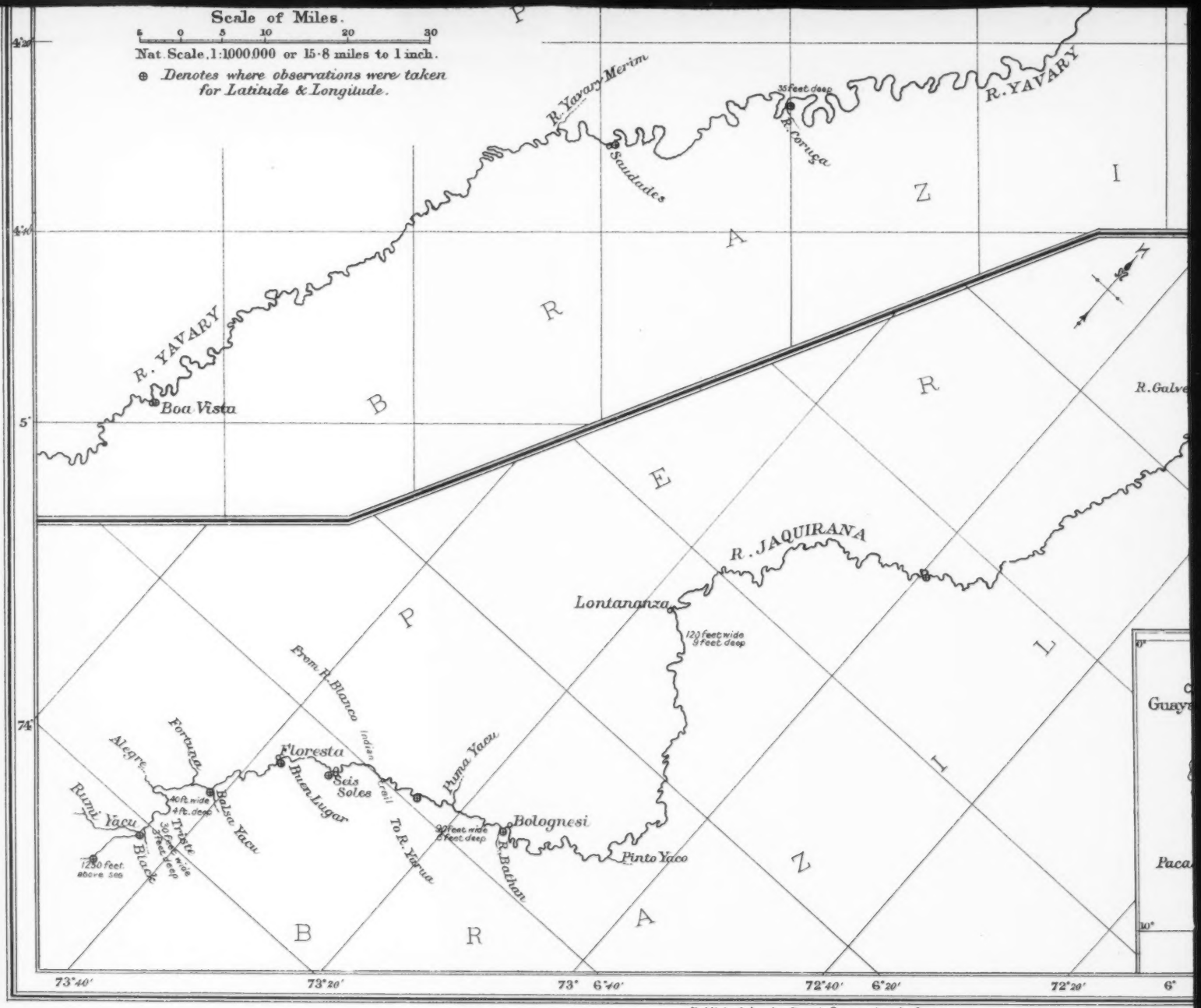
Roads _____ *Railways* ———

Ancient names thus ... PODANDOS.

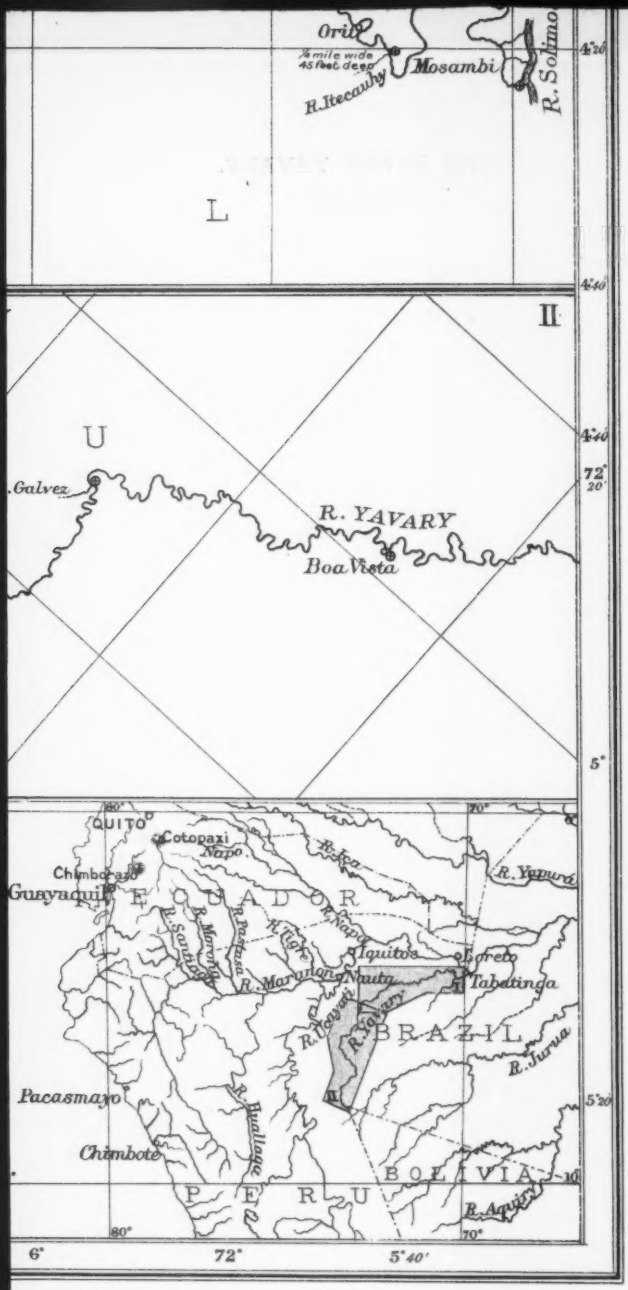



72°40'
72°20'
72°
71°40'
71°20'
71°
70°40'
4°
THE RIVER YAVARY.
Surveyed for the Bolivian Boundary Commission
by C. Satchell, 1901.
Scale of Miles.
5 0 5 10 20 30
N
E
R
P


70°40′
70°20′
70°
4°
I
U
Sta Theresa
Orid
imoes
4°20



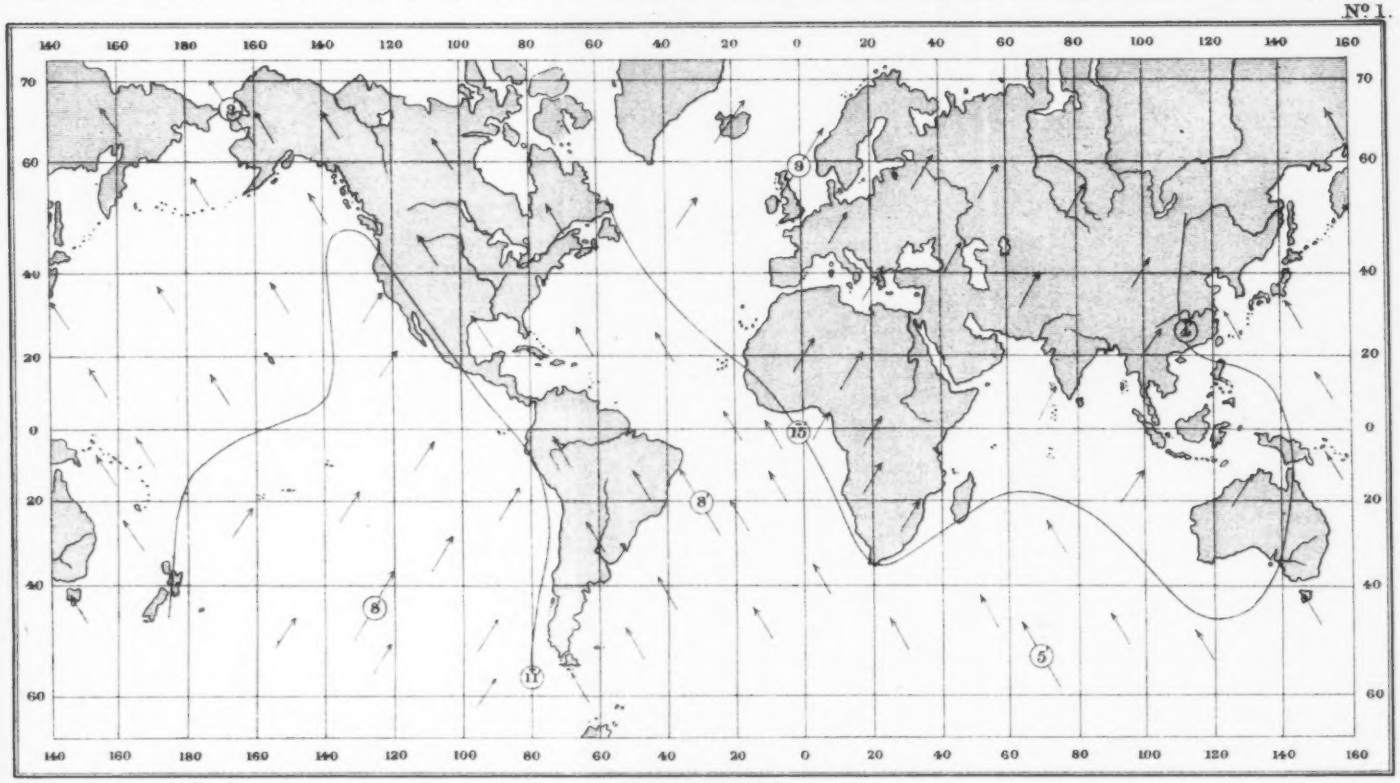
Published by the Royal Geographical Society.


Orio
¼ mile wide
45 feet deep
Mosambi
R. Itecauhy
R. Solimo
4°20'
L
4°40'
II
U
4°40'
72°
20'
Galvez
R. YAVARY
Boa Vista
5°
80°
70°
QUITO
Cotopazi
Napo
R. Ica
R. Yapura
Chimborazo
Guayaquil
E C U A D O R
R. Santiago
R. Morona
R. Pastaza
R. Ucayale
Iquitos
Loreto
R. Maranon
Nauta
Tabatinga
R. Javary
R. Iquari
BRAZIL
R. Jurua
Pacasmayo
R. Huallage
5°20'
Chimbote
BOLIVIA
P E R U
R. Aquiri
80°
70°
6°
72°
5°40'

MAP SHOWING

THE APPROXIMATE DISTRIBUTION OF THE SECULAR CHANGE IN THE MAGNETIC DECLINATION OR VARIATION. EPOCH 1840-1880.

No. 1.



EXPLANATION.

The arrows deflected to the right of the true meridian indicate regions in which the North seeking end of the needle is moving Eastward. Arrows deflected to the left that it is moving Westward. The Black curves pass through regions of no Secular change in the declination.

(5) *Indicate foci of maximum Secular change, the figures giving the annual value. The arrow on the circle the direction in which the needle is moving*

(+ 11) *Are foci of maximum Secular change in the Inclination, the figures giving the annual value.* { + *Signifies that the north seeking end of the needle moved downwards* / − *Signifies that the north seeking end of the needle moved upwards.*

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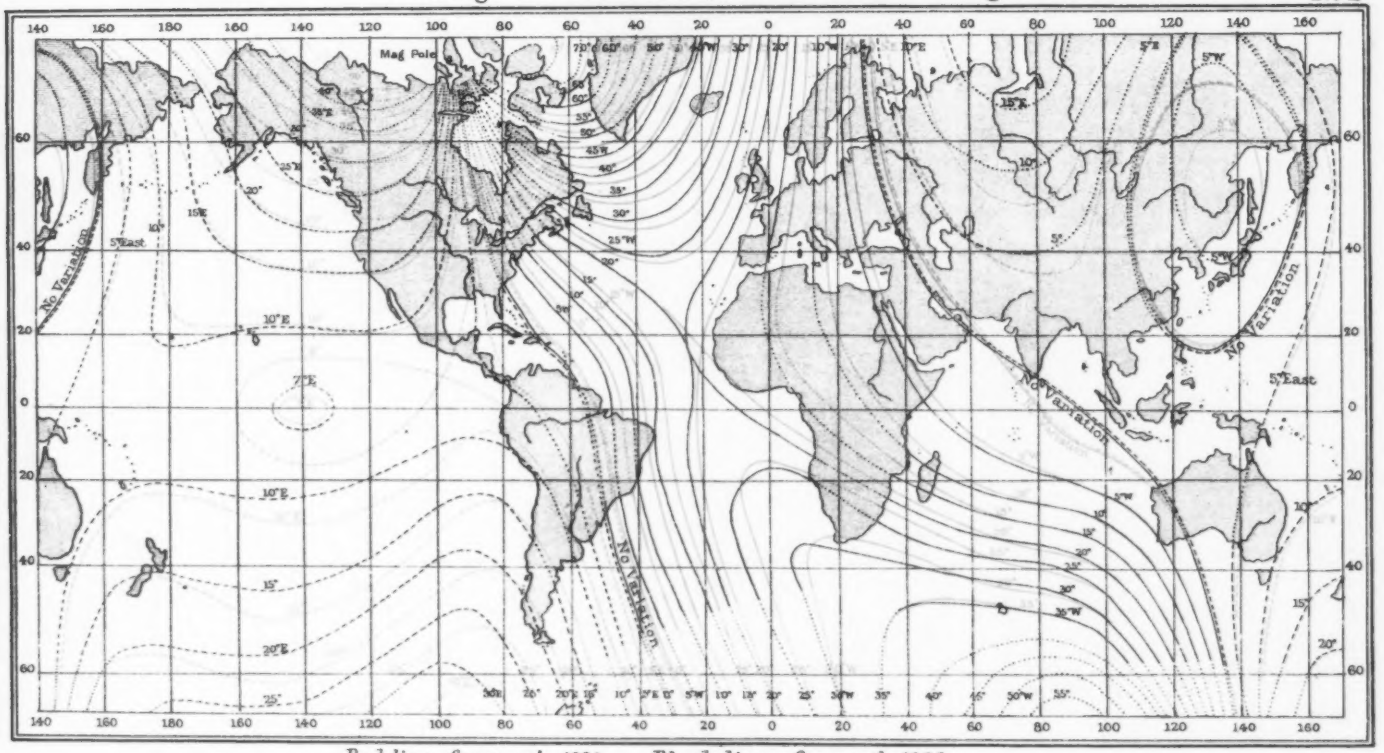
MAP SHOWING LINES OF EQUAL MAGNETIC DECLINATION OR VARIATION

Showing the effects of 15 years of secular change

No. 2



Red lines for epoch 1880. Black lines for epoch 1895.

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